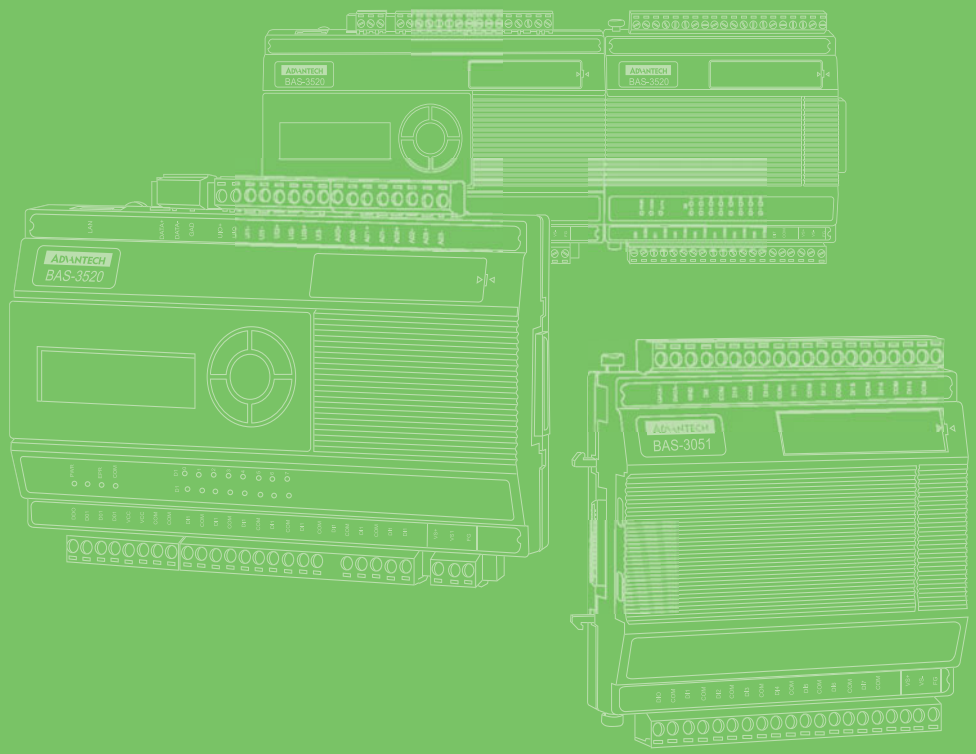
User Manual



BAS-3000BC Series

BACnet MS/TP Remote I/O Modules

ADVANTECH
Enabling an Intelligent Planet

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Product Warranty (2 years)

Advantech warrants to you, the original purchaser, that each of its products will be free from defects in materials and workmanship for two years from the date of purchase.

This warranty does not apply to any products which have been repaired or altered by persons other than repair personnel authorized by Advantech, or which have been subject to misuse, abuse, accident or improper installation. Advantech assumes no liability under the terms of this warranty as a consequence of such events.

Because of Advantech's high quality-control standards and rigorous testing, most of our customers never need to use our repair service. If an Advantech product is defective, it will be repaired or replaced at no charge during the warranty period. For out-of-warranty repairs, you will be billed according to the cost of replacement materials, service time and freight. Please consult your dealer for more details.

If you think you have a defective product, follow these steps:

1. Collect all the information about the problem encountered. (For example, CPU speed, Advantech products used, other hardware and software used, etc.) Note anything abnormal and list any onscreen messages you get when the problem occurs.
2. Call your dealer and describe the problem. Please have your manual, product, and any helpful information readily available.
3. If your product is diagnosed as defective, obtain an RMA (return merchandize authorization) number from your dealer. This allows us to process your return more quickly.
4. Carefully pack the defective product, a fully-completed Repair and Replacement Order Card and a photocopy proof of purchase date (such as your sales receipt) in a shippable container. A product returned without proof of the purchase date is not eligible for warranty service.
5. Write the RMA number visibly on the outside of the package and ship it prepaid to your dealer.

Part No. XXXXXXXXXX Edition 2

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Declaration of Conformity

CE

This product has passed the CE test for environmental specifications when shielded cables are used for external wiring. We recommend the use of shielded cables. This kind of cable is available from Advantech. Please contact your local supplier for ordering information.

CE

This product has passed the CE test for environmental specifications. Test conditions for passing included the equipment being operated within an industrial enclosure. In order to protect the product from being damaged by ESD (Electrostatic Discharge) and EMI leakage, we strongly recommend the use of CE-compliant industrial enclosure products.

FCC Class A

Note: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

FCC Class B

Note: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

FM

This equipment has passed the FM certification. According to the National Fire Protection Association, work sites are classified into different classes, divisions and groups, based on hazard considerations. This equipment is compliant with the specifications of Class I, Division 2, Groups A, B, C and D indoor hazards.

Technical Support and Assistance

1. Visit the Advantech web site at www.advantech.com/support where you can find the latest information about the product.
2. Contact your distributor, sales representative, or Advantech's customer service center for technical support if you need additional assistance. Please have the following information ready before you call:
   - Product name and serial number
   - Description of your peripheral attachments
   - Description of your software (operating system, version, application software, etc.)
   - A complete description of the problem
   - The exact wording of any error messages

Warnings, Cautions and Notes

Warning! *Warnings indicate conditions, which if not observed, can cause personal injury!*

Caution! *Cautions are included to help you avoid damaging hardware or losing data. e.g.*

There is a danger of a new battery exploding if it is incorrectly installed. Do not attempt to recharge, force open, or heat the battery. Replace the battery only with the same or equivalent type recommended by the manufacturer. Discard used batteries according to the manufacturer's instructions.

Note! *Notes provide optional additional information.*

Document Feedback

To assist us in making improvements to this manual, we would welcome comments and constructive criticism. Please send all such - in writing to: support@advantech.com

Safety Precaution - Static Electricity

Follow these simple precautions to protect yourself from harm and the products from damage.

- To avoid electrical shock, always disconnect the power from your PC chassis before you work on it. Don't touch any components on the CPU card or other cards while the PC is on.

Disconnect power before making any configuration changes. The sudden rush of power as you connect a jumper or install a card may damage sensitive electronic components.

Safety Instructions

1. Read these safety instructions carefully.
2. Keep this User Manual for later reference.
3. Disconnect this equipment from any AC outlet before cleaning. Use a damp cloth. Do not use liquid or spray detergents for cleaning.
4. For plug-in equipment, the power outlet socket must be located near the equipment and must be easily accessible.
5. Keep this equipment away from humidity.
6. Put this equipment on a reliable surface during installation. Dropping it or letting it fall may cause damage.
7. The openings on the enclosure are for air convection. Protect the equipment from overheating. DO NOT COVER THE OPENINGS.
8. Make sure the voltage of the power source is correct before connecting the equipment to the power outlet.
9. Position the power cord so that people cannot step on it. Do not place anything over the power cord.
10. All cautions and warnings on the equipment should be noted.
11. If the equipment is not used for a long time, disconnect it from the power source to avoid damage by transient overvoltage.
12. Never pour any liquid into an opening. This may cause fire or electrical shock.
13. Never open the equipment. For safety reasons, the equipment should be opened only by qualified service personnel.
14. If one of the following situations arises, get the equipment checked by service personnel:

- The power cord or plug is damaged.
- Liquid has penetrated into the equipment.
- The equipment has been exposed to moisture.
- The equipment does not work well, or you cannot get it to work according to the user's manual.
- The equipment has been dropped and damaged.
- The equipment has obvious signs of breakage.

15. DO NOT LEAVE THIS EQUIPMENT IN AN ENVIRONMENT WHERE THE STORAGE TEMPERATURE MAY GO BELOW -20° C (-4° F) OR ABOVE 70° C (158° F). THIS COULD DAMAGE THE EQUIPMENT. THE EQUIPMENT SHOULD BE IN A CONTROLLED ENVIRONMENT.
16. CAUTION: DANGER OF EXPLOSION IF BATTERY IS INCORRECTLY REPLACED. REPLACE ONLY WITH THE SAME OR EQUIVALENT TYPE RECOMMENDED BY THE MANUFACTURER, DISCARD USED BATTERIES ACCORDING TO THE MANUFACTURER'S INSTRUCTIONS.
17. The sound pressure level at the operator's position according to IEC 704-1:1982 is no more than 70 dB (A).

DISCLAIMER: This set of instructions is given according to IEC 704-1. Advantech disclaims all responsibility for the accuracy of any statements contained herein.

Contents

Chapter 1 System Overview.....1

1.1 Introduction 2
1.2 Features 2
1.3 Hardware Specifications 2
1.3.1 BAS-3050BC Hardware Specifications 2
1.3.2 BAS-3051BC Hardware Specifications 3
1.3.3 BAS-3018BC Hardware Specifications 3
1.3.4 BAS-3024BC Hardware Specifications 4
1.3.5 BAS-3500BC DDC Hardware Specifications 5
1.3.6 Indicator 5
1.3.7 Environment 6
1.4 BAS-3000BC Series Dimensions 6
1.5 BAS-3000BC Wall Mounting Dimensions 8

Chapter 2 Documentation & Compatibility 9

2.1 Document Introduction 10
2.2 Protocol Implementation Conference Statement 10
Table 2.1: BACnet Protocol Implementation Conformance Statement 10
2.3 BACnet Objects Supported By BAS-3000BC 13
2.3.1 Analog Input 13
2.3.2 Analog Output 14
2.3.3 Binary Input 15
2.3.4 Binary Output 16
2.3.5 Device 17
2.4 Application Services 18

Chapter 3 Installation.....21

3.1 Remote I/O Module 22
3.2 DDC Module (BAS-3500BC) 24
3.3 DDC and Remote I/O Module Installation Diagram 25

Chapter 4 Domain Focused Config Tool.....27

4.1 Domain Focused Configuration Tool 28
4.2 Domain Focused Configuration Tool Usage 28
4.2.1 Installation Procedure 28
4.2.2 Software Usage 30
4.3 Hardware Operation 32
4.3.1 Device Management 32
4.3.2 Connection Device Information 35
4.3.3 Firmware Updates 36
4.4 Hardware Parameter Configuration 37
4.4.1 DI Configuration 37
4.4.2 DO Configuration 38
4.4.3 UI Configuration 39
4.4.4 AO Configuration 42
4.5 Object List of Each Module 44
4.5.1 AI Object Property 45
4.5.2 AO Object Property 47

4.5.3 BI Object Property 49
4.5.4 BO Object Property 50
4.5.5 Device Object Property 53

Chapter 5 Visual Testing Shell 57

Chapter 5 For BACnet 57

5.1 Introduction 58
5.2 Obtaining and Installing VTS 58
5.3 Configuring VTS 59
5.3.1 Device Configuration 60
5.3.2 Port Configuration 61
5.3.3 Name Configuration 63
5.4 Sending BACnet Packet 65
5.4.1 Read Property 67
5.4.2 Write Property 70
5.5 Analyze BACnet Packet 73

Appendix A I/O Wiring 75

A.1 BAS-3051BC 76
Figure A.1 BAS-3051BC Connection 76
A.2 BAS-3050BC 76
Figure A.2 BAS-3050BC Connection 76
A.3 BAS-3018BC 77
Figure A.3 BAS-3018BC Connection 77
A.4 BAS-3024BC 77
Figure A.4 BAS-3024BC Connection 77
Figure A.5 BAS-3500BC Connection 78

Chapter B RS-485 Network 79

B.1 Introduction 80
B.2 Daisychain 80
Figure B.1 Daisychaining 80
B.2.1 Star Topology 81
Figure B.2 Star Topology 81
B.2.2 Random Topology 81
Figure B.3 Line Termination 81
Figure B.4 Signal Distortion 81
B.3 Line Termination 82

Chapter 1

System Overview

1.1 Introduction

3000BC series include Advantech BACNet MS/TP DDC and remote I/O modules with RS-485 interfaces. BACNet MS/TP remote I/O modules can be expanded as remote I/O modules for Adcantech BACNet MS/TP DDC controllers or 3rd party BACNet MS/TP DDC controllers. The BAS-3500BC is an Ethernet-based, standalone programmable controller specially designed for the BACnet standard building automation (BA) applications. It supports BACNet MS/TP and Modbus protocol, also features powerful BASPro programming tool which delivers many function blocks suitable for BA application, such as scheduler, HVAC, sequential control, PID control, alarm, and event. The I/O expansion modules (BAS-3018BC, BAS-3024BC, BAS-3050BC, BAS-3051BC) provide more I/O points and make the system a scalable solution.

BAS-3000BC series provides DDC and I/O models with predefined BACNet objects and services listed as PICS to ensure seamless communication each other.

1.2 Features

- Supports 9600, 19.2k, 38.4k, and 76.8k bps
- Supports master-slave
- Supports BACnet MS/TP protocol
- Support Modbus protocol
- Support Local Bus (AdvanTech product use)

1.3 Hardware Specifications

1.3.1 BAS-3050BC Hardware Specifications

General

- Power Consumption: 4 W (max) @ 24 V_{DC}
- Power Supply: 24 VAC/ 24 V_{DC} (±10%)

Communication

- Serial Interface: RS-485

Digital Input

- Channels: 8
- Dry Contact:
  - Logic level 0: Open
  - Logic level 1: Close to Ground
- Supports 1 kHz pulse/accumulator input (maximum any 2 channels supported)
- Isolation Protection: 3000 V_{DC}

Digital Output

- Channels: 8
- Source type: 30 V @ 1 A (resistive load)
- PWM period: 2ms~3600sec (maximum any 2 channels supported)
- PWM minimum duty on (pulse width): 0.2ms
- PWM rising time: 170us, falling time: 160us
- Isolation Protection: 3000 V_{DC}

1.3.2 BAS-3051BC Hardware Specifications

General

- Power Consumption: 3 W (max) @ 24 V_{DC}
- Power Supply: 24 VAC/ 24 V_{DC} (±10%)

Communication

- Serial Interface: RS-485

Digital Input

- Channels: 16
- Dry Contact:
  - Logic level 0: Open
  - Logic level 1: Close to Ground
- Supports 1 kHz pulse/accumulator input (maximum any 2 channels supported)
- Isolation Protection: 3000 V_{DC}

1.3.3 BAS-3018BC Hardware Specifications

General

- Power Consumption: 3 W (max) @ 24 V_{DC}
- Power Supply: 24 VAC/ 24 Vv (±10%)

Communication

- Serial Interface: RS-485

Analog Input

- Channels: 8
- Input Type: V, mA, RTD, Thermistor, DI (Dry Contact)
- Voltage Range: 0 ~ 10V
- Current Range: 0~20 mA, 4~20 mA (for both, need to add a 125 ohm resistor)
- RTD and Thermistor Type (3k, 10K)
- Pt 100 (2-wire) Temperature Range:
  -50 ~ 150° C
  0 ~ 100° C
  0 ~ 200° C
  0 ~ 400° C
  -50 ~ 200° C
  - IEC RTD 100 ohms (= 0.0385)
  - JIS RTD 100 ohms (= 0.0392)
  - Pt 1000 (2-wire): -40 ~ 160° C
  - Thermistor 3k, 10 k: -20 ~ 100° C
- Input Impedance: 2M (voltage),120 (current)
- Accuracy: ±0.1%, (voltage); ±0.1% (current); ±0.5° C (RTD); ±1° C (Thermistor); or better
- Span Drift: ±25 ppm/° C
- Zero Drift: ±6 V/° C
- Resolution: 16-bit
- Sampling Rate: 10 sample/second
- CMR @ 50/60 Hz: 90 dB
- NMR @ 50/60 Hz: 60 dB
- Over Voltage Protection: ±35 V_{DC}
- Built-in TVS/ESD Protection

1.3.4 BAS-3024BC Hardware Specifications

General

- Power Consumption: 4 W (max) @ 24 V_{DC}
- Power Supply: 24 VAC/ 24 V_{DC} (±10%) (used as remote I/O)
- Operating Temperature: 0~60° C
- Storage Temperature: -20~80 C
- Operating Humidity: 20~95%
- Storage Humidity: 0~95%

Communication

- Serial Interface: RS-485

Analog Input

- Channels: 4
- Input Type: V, mA, RTD, Thermistor, DI (Dry Contact)
- Voltage Range: 0 ~ 10V
- Current Range: 0~20 mA, 4~20 mA
- RTD and Thermistor Type(3k, 10K)
- Pt 100 (2-wire) Temperature Range:
  -50 ~ 150° C
  0 ~ 100° C
  0 ~ 200° C
  0 ~ 400° C
  -50 ~ 200° C
  - IEC RTD 100 ohms (= 0.0385)
  - JIS RTD 100 ohms (= 0.0392)
  - Pt 1000 (2-wire): -40 ~ 160° C
  - Thermistor 3k, 10 k: -20 ~ 100° C
- Input Impedance: > 2 M (voltage), 120 (current), 125
- Accuracy: ±0.1%, (voltage); ±0.1% (current); ±0.5° C (RTD); ±1° C (Thermistor); or better
- Span Drift: ±25 ppm/° C
- Zero Drift: ±6 V/° C
- Resolution: 16-bit
- Sampling Rate: 10 sample/second
- CMR @ 50/60 Hz: 90 dB
- NMR @ 50/60 Hz: 60 dB
- Over Voltage Protection: ±35 V_{DC}
- Built-in TVS/ESD Protection

Analog Output

- Channels: 4
- Range: 0 ~ 10 VDC, 0~20 mA, 4~20 mA
- Accuracy: ±0.1% of FSR (voltage), ±0.2% of FSR (current)
- Resolution: 12-bit
- Current Load Resistor: 0 ~ 500 ohm
- Drift: ±50 ppm/° C
- Common Ground

Digital Output

- Channels: 4
- Source type: 30 V @ 1 A (resistive load)
- PWM period: 2ms~3600sec (maximum any 2 channels supported)
- PWM minimum Duty on (pulse width): 0.2ms
- PWM rising time:170us, falling time: 160us
- Isolation Protection: 3000 V_{DC}

1.3.5 BAS-3500BC DDC Hardware Specifications

General

- Certifications: CE, FCC,BTL
- Mounting: DIN-rail, wall mount
- Dimension (W x H x D): 176 x 110 x 39.2mm (6.93" x 4.33" x 1.54")
- Power Input: 24V_{DC}/24VAC
- Power Consumption: 3W@24V_{DC}
- Real-time Clock: Yes
- Watchdog Timer: Yes

Hardware

- CPU: 32-bit CPU 312 MHZ
- Flash Memory: 32MB
- RAM: 64M SDRAM
- Battery Backup SRAM: 512KB

Communication

- LAN: 1 x 10/100Base-T (RJ-45) BACNet/IP server
- COM1: RS-485 BACnet MS/TP
- COM2: RS-485 BACnet MS/TP
- COM3: RS-485 Modbus RTU Master
- COM4: RS-485 A Bus Extension (AdvanTech product use)

1.3.6 Indicator

DDC:

There are 11 system indicators on the front panel of the BAS-3500BC DDC for indicating the running status.

- Power: Power indicator. The indicator will be turned on when module is power on.
- Run/RDY: Function block and control logic running status / Kernel Ready indicator. The indicator will flicker when module is ready to operate function block or control logic.
- Error: System error indicator.
- COMM: There are 8 communication lights. The indicator will flicker when the module is transmitting and receiving communication packets via communication port.

I/O Module:

There are four system indicators on the front panel of the expansion module BAS-3000BC I/O for indicating the running status.

- Power: Power indicator. The indicator will be turned on when the expansion module is power on.
- COMM: There are two communication lights. The indicator will flicker when the module is transmitting and receiving communication packets.
- Error: System error indicator.

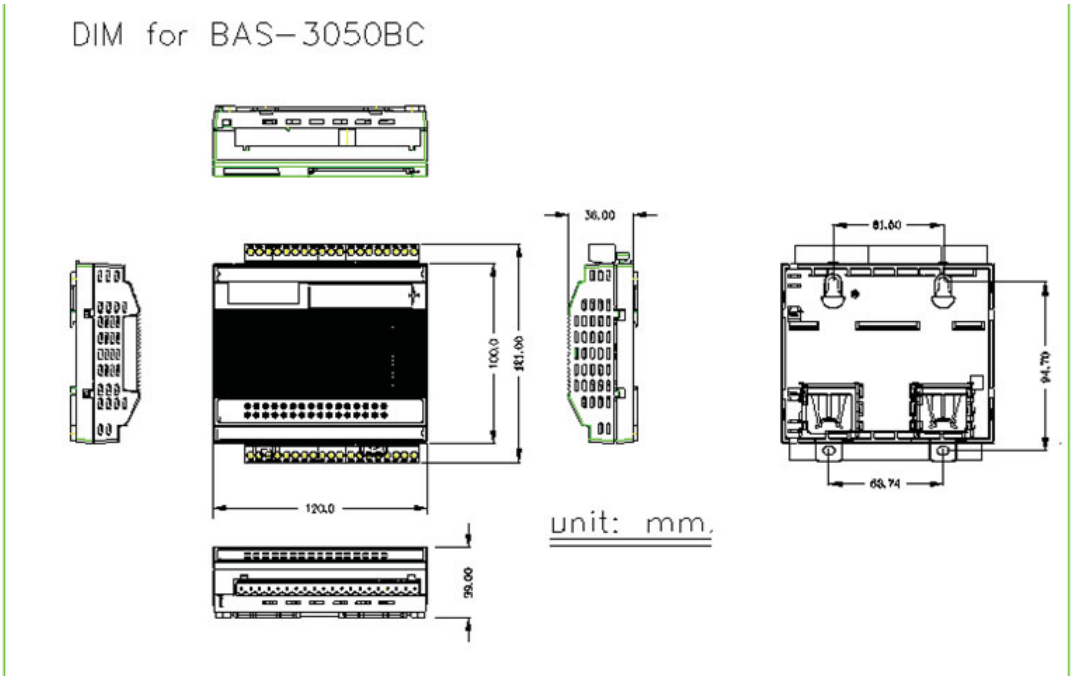
There are also multiple DI/O status indicators by the side of the system indicators. If the value of the digital input/output channel is logic high, its relative DI/O status indicator will be turned on.

1.3.7 Environment

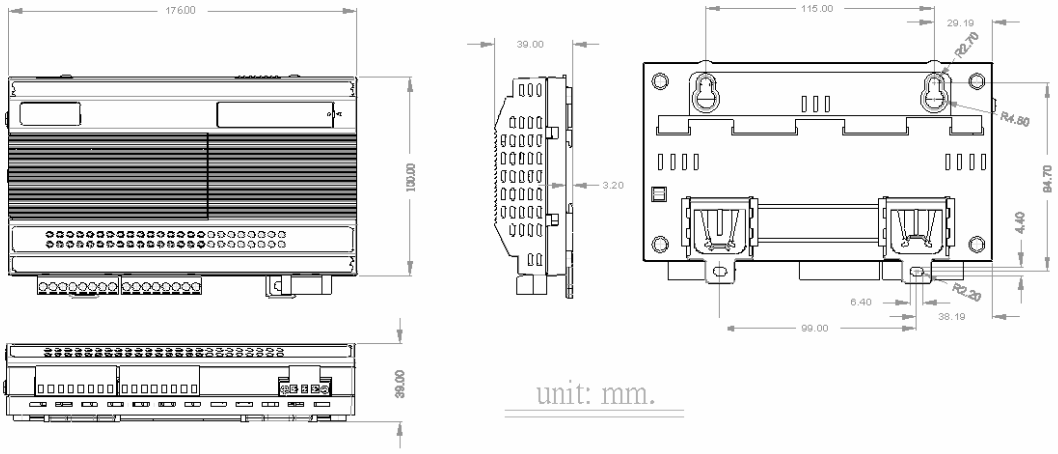
- Operating Temperature: -10~60° C
- Storage Temperature: -20~80° C
- Operating Humidity: 20~95% (non-condensing)
- Storage Humidity: 0 ~ 95% (non-condensing)

Note! *Static electricity will be generated if the relative humidity of environment is below 30%. Therefore, the user must take measures against static electricity, such as grounding.*

1.4 BAS-3000BC Series Dimensions

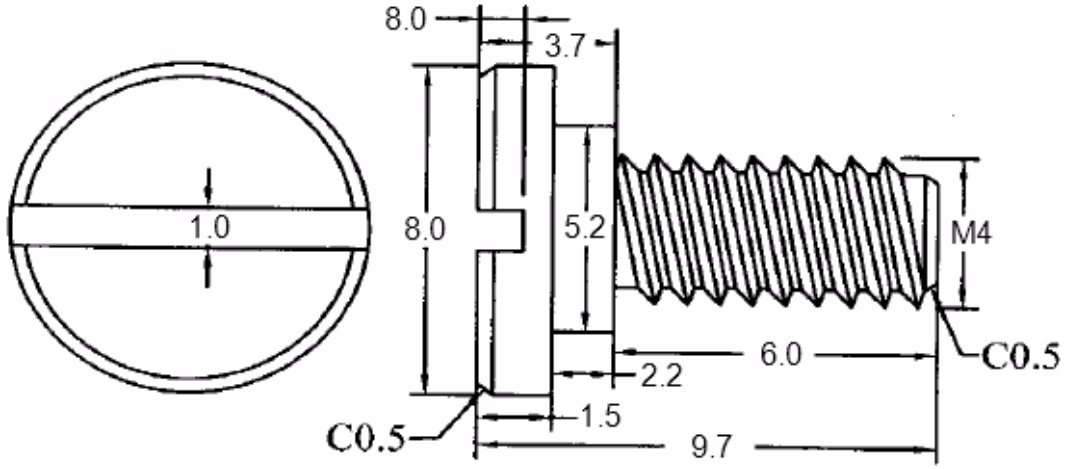


DIM for BAS-3500BC

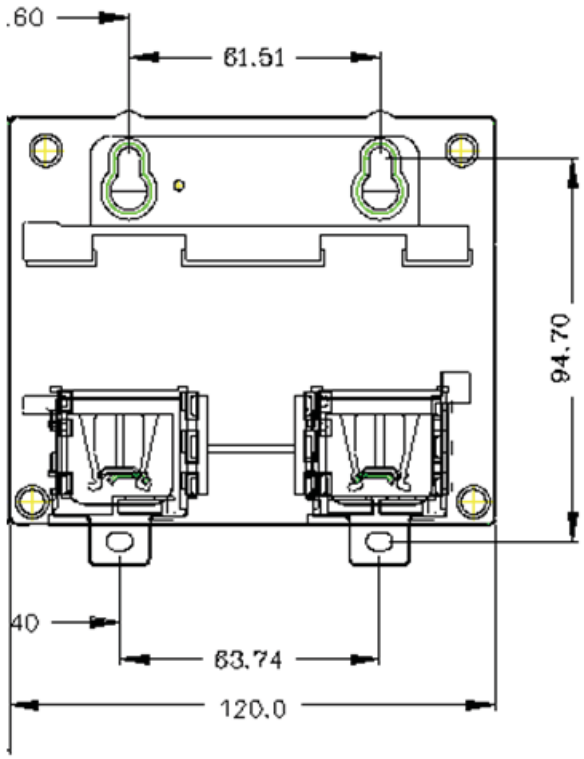


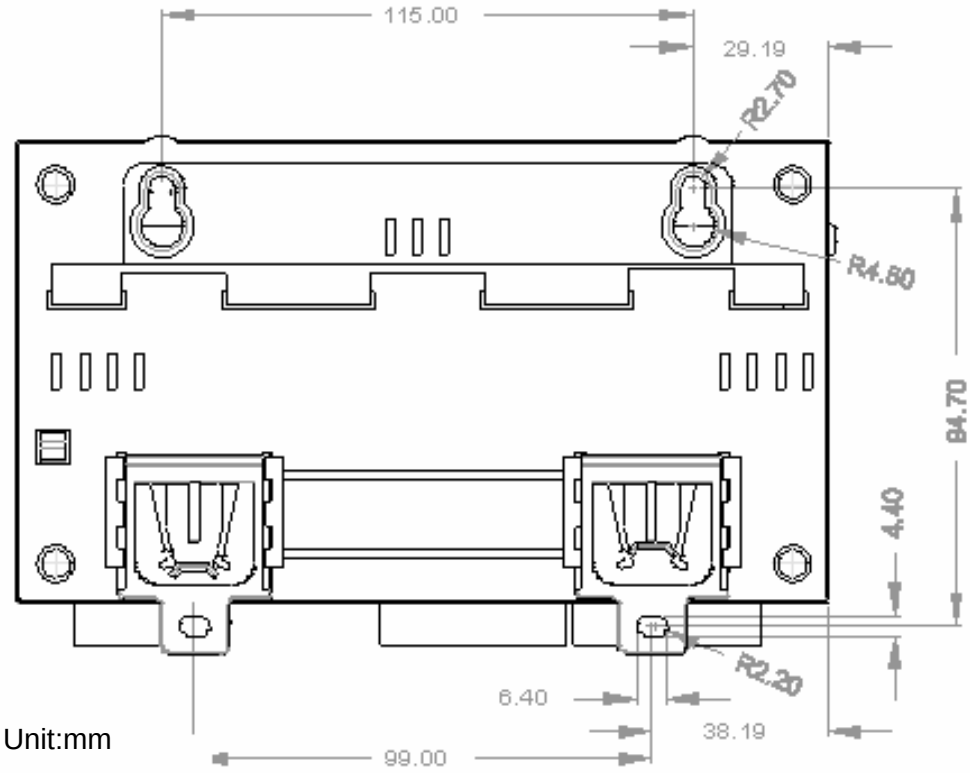
Wall Mount Screw Dimension

Unit : mm



1.5 BAS-3000BC Wall Mounting Dimensions





Unit:mm

Chapter 2

Documentation & Compatibility

2.1 Document Introduction

This document contains the Protocol Implementation Conformance Statement (PICS) and BACnet® Interoperability Building Blocks (BIBBs) for the Advantech BAS-3000BC series I/O module as required by the American National Standards Institute/ American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ANSI/ ASHRAE) Standard 135-2008, BACnet protocol.

The PICS is a written document created by the manufacturer of a device to identify the particular options specified in the BACnet standard and implemented in the device. BACnet interoperability building blocks are collections of one or more BACnet services. This document includes a listing of the BIBBs currently supported by the BAS-3000BC I/O module.

2.2 Protocol Implementation Conference Statement

Annex A - Protocol Implementation Conformance Statement (Normative)

Table 2.1: BACnet Protocol Implementation Conformance Statement

Vendor Name	Advantech Corp.
Product Name	Advantech BAS-3000BC series BACnet Sensor
Product Model Numbers	BAS-3018BC, BAS-3024BC, BAS-3050BC, BAS-3051BC
Applications Software Version	Not Applicable
Firmware Version	2.2.1.18
BACnet Protocol Revision	Version 1, Revision 7

BACnet Standardized Device Profile)

☐	BACnet Operator Workstation (B-OWS)
☐	BACnet Building Controller (B-BC)
☐	BACnet Advanced Application Controller (B-AAC)
☐	BACnet Application Specific Controller (B-ASC)
☒	BACnet Smart Sensor (B-SS)
☐	BACnet Smart Actuator (B-SA)

Note! *For a complete listing of the additional BIBBs supported (Annex K), see the Annex K - BACnet Interoperability Building Blocks (BIBBs) (Normative) section of this document.*

BACnet Interoperability Building Blocks (BIBBs)

Table 2 lists all the BIBBs that are required for the BACnet Application I/O module profile and the support for these BIBBs within Advantech Building Automation System.

The BIBBS that are not required are also listed.

BACnet B-SS BIBBs Support

Application Service (B-SS)	**Designation**	**Supported**
Required for B-SS Profile		
Data Sharing - Read Property - B	DS-RP-B	☐
Data Sharing - Write Property - B	DS-WP-B	☐
Device Management - Dynamic Device Binding - B	DM-DDB-B	☐
Device Management - Dynamic Object Binding - B	DM-DOB-B	☐
Not Required For B-SS Profile		
Data Sharing - Read Property Multiple - B	DS-RPM-B	☐
Data Sharing - Write Property Multiple - B	DS-WPM-B	☐
A = Initiates B = Executes		

BACnet Standard Object Types Supported.

The following is a list of the standard object types as defined by ASHRAE. The objects checked are currently supported by this product. See the section in this document for the supported object type for details.

☐	Accumulator
☒	Analog Input
☒	Analog Output
☐	Analog Value
☐	Averaging
☒	Binary Input
☒	Binary Output
☐	Binary Value
☐	Calendar
☐	Command
☒	Device
☐	Event Enrollment
☐	File
☐	Group
☐	Life Safety Point

☐	Life Safety Zone
☐	Loop
☐	Multistate Input
☐	Multistate Output
☐	Multistate Value
☐	Notification Class
☐	Program
☐	Pulse Converter
☐	Schedule
☐	Trend Log

Data Link Layer Option

☐	BACnet Internet Protocol (IP) (Annex J)
☐	BACnet IP (Annex J), Foreign Device
☐	ISO 8802-3, Ethernet (Clause 7)
☐	ANSI/ATA 878.1, 2.5 MB ARCNET network (Clause 8)
☐	ANSI/ATA 878.1, RS-485 ARCNET network (Clause 8), baud rates:
☒	Master-Slave/Token-Passing (MS/TP) master (Clause 9), baud rates: 9600,19200, 38400,76800
☐	MS/TP slave (Clause 9), baud rates:
☐	Point-To-Point, EIA 232 (Clause 10), baud rates:
☐	Point-To-Point, modem (Clause 10), baud rates:
☐	LonTalk. protocol (Clause 11), medium:
☐	Other:

Character Sets Supported

Indicating support for multiple character sets does not imply that they can all be supported simultaneously.

☒	ANSI X3.4	☐	IBM /Microsoft DBCS	☐	ISO 8859-1
☐	ISO 10646 (UCS-2)	☐	ISO 10646 (UCS-4)	☐	JIS C 6226

2.3 BACnet Objects Supported By BAS-3000BC

Object List of Each Module

Module Name	Object Numbers				
	AI	AO	BI	BO	Device
BAS-3018BC	8	0	0	0	1
BAS-3024BC	4	4	0	4	1
BAS-3050BC	0	0	8	8	1
BAS-3051BC	0	0	0	16	1

2.3.1 Analog Input

Analog Input Objects are supported by: BAS-3018BC, BAS-3024BC.

Dynamically Creatable: No

Dynamically Deletable: No

Property Name	Required	Optional	Proprietary	Writable	Property ID	Data Type
OBJECT_IDENTIFIER	✓					
OBJECT_NAME	✓					
OBJECT_TYPE	✓					
PRESENT_VALUE	✓					
DESCRIPTION		✓		✓		Character-String
STATUS_FLAGS	✓					
EVENT_STATE	✓					
OUT_OF_SERVICE	✓					
UNITS	✓					
RANGECODE_CONFIG			✓	✓	1001	Enumerated
TEMPERATURECOMPENSATION_VALUE			✓	✓	4001	Real
ZEROCALIBRATION_CMD			✓	✓	7001	Enumerated
SPANCALIBRATION_CMD			✓	✓	7002	Enumerated
MIDDLECALIBRATION_CMD			✓	✓	7003	Enumerated

2.3.2 Analog Output

Analog Output Objects are supported by: BAS-3024BC.

Dynamically Creatable: No

Dynamically Deletable: No

Property Name	Required	Optional	Proprietary	Writable	Property ID	Data Type
OBJECT_IDENTIFIER	✓					
OBJECT_NAME	✓					
OBJECT_TYPE	✓					
PRESENT_VALUE	✓			✓		
DESCRIPTION		✓		✓		Character String
STATUS_FLAGS	✓					
EVENT_STATE	✓					
OUT_OF_SERVICE	✓					
UNITS	✓					
PRIORITY_ARRAY	✓					
RELINQUISH_DEFAULT	✓					
RANGECODE_CONFIG			✓	✓	1001	Enumerated
ZEROCALIBRATION_CMD			✓	✓	7001	Enumerated
SPANCALIBRATION_CMD			✓	✓	7002	Enumerated
KEEPLASTVALUE_CMD			✓	✓	8001	Boolean

2.3.3 Binary Input

Binary Input Objects are supported by: BAS-3050BC, BAS-3051BC.

Dynamically Creatable: No

Dynamically Deletable: No

Property Name	Required	Optional	Proprietary	Writable	Property ID	Data Type
OBJECT_IDENTIFIER	✓					
OBJECT_NAME	✓					
OBJECT_TYPE	✓					
PRESENT_VALUE	✓					
DESCRIPTION		✓		✓		CharacterString
STATUS_FLAGS	✓					
EVENT_STATE	✓					
OUT_OF_SERVICE	✓					
POLARITY	✓					
RANGECODE_CONFIG			✓	✓	1001	Enumerated
STARTSTOP_CMD			✓	✓	6001	Boolean
POWERON_STARTSTOP_CMD			✓	✓	2003	Boolean
ACCUMULATION_VALUE			✓		2001	Unsigned
PULSEINPUT_VALUE			✓		2002	Real

2.3.4 Binary Output

Binary Output Objects are supported by: BAS-3050BC, BAS-3024BC.

Dynamically Creatable: No

Dynamically Deletable: No

Property Name	Required	Optional	Proprietary	Writable	Property ID	Data Type
OBJECT_IDENTIFIER	✓					
OBJECT_NAME	✓					
OBJECT_TYPE	✓					
PRESENT_VALUE	✓			✓		
DESCRIPTION		✓		✓		Character-String
STATUS_FLAGS	✓					
EVENT_STATE	✓					
OUT_OF_SERVICE	✓					
POLARITY	✓					
PRIORITY_ARRAY	✓					
RELINQUISH_DEFAULT	✓					
RANGECODE_CONFIG			✓	✓	1001	Enumerated
STARTSTOP_CMD			✓	✓	6001	Boolean
DUTYCYCLE_VALUE			✓	✓	3001	Unsigned
PERIOD_VALUE			✓	✓	3002	Real
KEEPLASTVALUE_CMD			✓	✓	8001	Boolean

2.3.5 Device

Dynamically Creatable: No

Dynamically Deletable: No

Property Name	Required	Optional	Proprietary	Writable	Property ID	Data Type
OBJECT_IDENTIFIER	✓					
OBJECT_NAME	✓					
OBJECT_TYPE	✓					
SYSTEM_STATUS	✓					
VENDOR_NAME	✓					
VENDOR_IDENTIFIER	✓					
MODEL_NAME	✓					
FIRMWARE_REVISION	✓					
APPLICATION_SOFTWARE_VERSION	✓					
DESCRIPTION		✓		✓		CharacterString
PROTOCOL_VERSION	✓					
PROTOCOL_REVISION	✓					
PROTOCOL_SERVICES_SUPPORTED	✓					
PROTOCOL_OBJECT_TYPES_SUPPORTED	✓					
OBJECT_LIST	✓					
MAX_APDU_LENGTH_ACCEPTED	✓					
SEGMENTATION_SUPPORTED	✓					
APDU_TIMEOUT	✓					
NUMBER_OF_APDU_RETRIES	✓					
MAX_MASTER	✓			✓		
MAX_INFO_FRAMES	✓					
DEVICE_ADDRESS_BINDING	✓					
DATABASE_REVISION	✓					
DEVICEINSTANCE_CONFIG			✓	✓	9002	Unsigned
FACTORYRESET_CMD			✓	✓	9004	Enumerated
INTEGRATIONTIME_CONFIG			✓	✓	9005	Enumerated
IO_NUMBER_VALUE			✓		9006	Enumerated

2.4 Application Services

Table 13 lists all the BACnet standard application services. The checked services are supported by the BAS-3000BC series devices.

Application Service	Initiates Requests	Executes Requests
AcknowledgeAlarm	☐	☐
AddListElement	☐	☐
AtomicReadFile	☐	☐
AtomicWriteFile	☐	☐
Authenticate	☐	☐
ConfirmedCOVNotification	☐	☐
ConfirmedEventNotification	☐	☐
ConfirmedPrivateTransfer	☐	☐
ConfirmedTextMessage	☐	☐
CreateObject	☐	☐
DeleteObject	☐	☐
DeviceCommunicationControl	☐	☐
GetAlarmSummary	☐	☐
GetEnrollmentSummary	☐	☐
GetEventInformation	☐	☐
I-Am	☒	☐
I-Have	☒	☐
LifeSafetyOperation	☐	☐
ReadProperty	☐	☐
ReadPropertyConditional	☐	☐
ReadPropertyMultiple	☐	☒
ReadRange	☐	☐
ReinitializeDevice	☐	☐
RemoveListElement	☐	☐
RequestKey	☐	☐
SubscribeCOV	☐	☐
SubscribeCOVProperty	☐	☐
TimeSynchronization	☐	☐

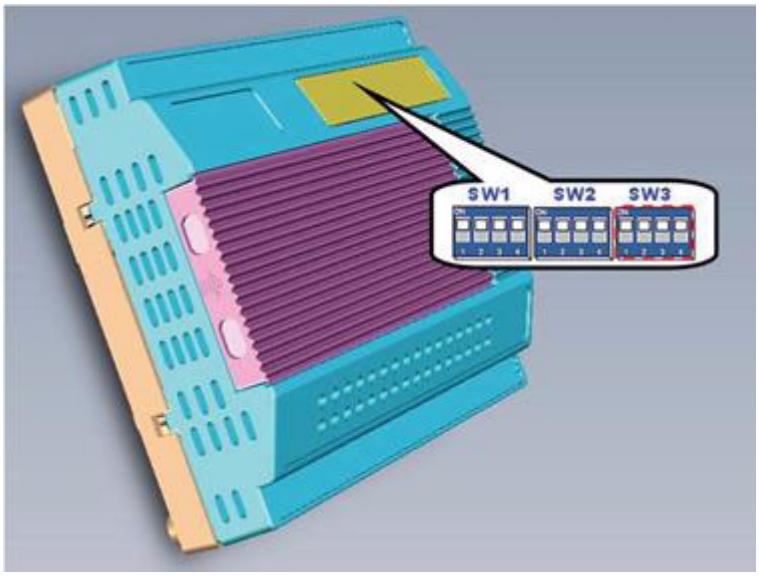
UnconfirmedCOVNotification	☐	☐
UnconfirmedEventNotification	☐	☐
UnconfirmedPrivateTransfer	☐	☐
UnconfirmedTextMessage	☐	☐
UTCTimeSynchronization	☐	☐
VT-Close	☐	☐
VT-Data	☐	☐
VT-Open	☐	☐
Who-Has	☐	☒
Who-Is	☐	☒
WriteProperty	☐	☒
WritePropertyMultiple	☐	☒

Chapter 3

Installation

3.1 Remote I/O Module

1. Set the baud rate of RS-485: Use screwdriver to open right-upper cover, turn SW3 switch on/off for the baud rate defined as below table.

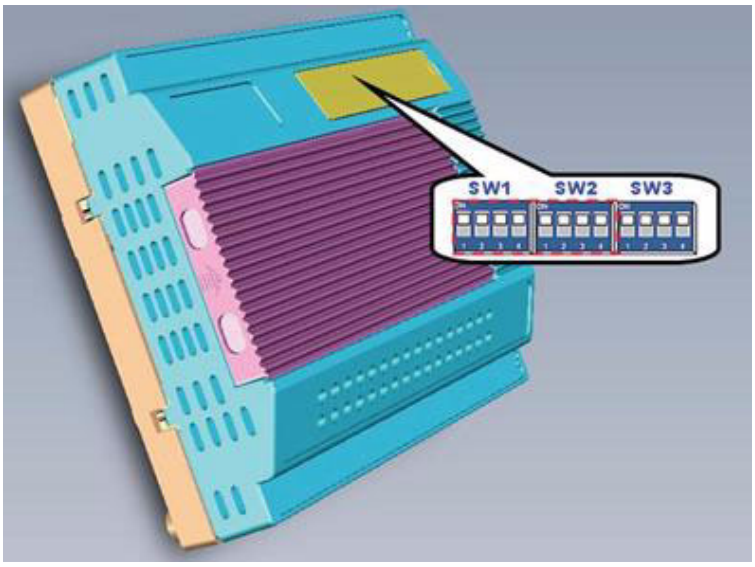


Baud Rate Table	
SW3_1_2_3_4	Baud Rate(bps)
1_0_0_0	9600
0_1_0_0	19200
1_1_0_0	38400
0_0_1_0	76800

MS/TP and Local Bus Switch Table	
SW3 _1_2_3_4	Protocol Mode
X_X_X_0	BACNet MS/TP
X_X_X_1	Local Bus

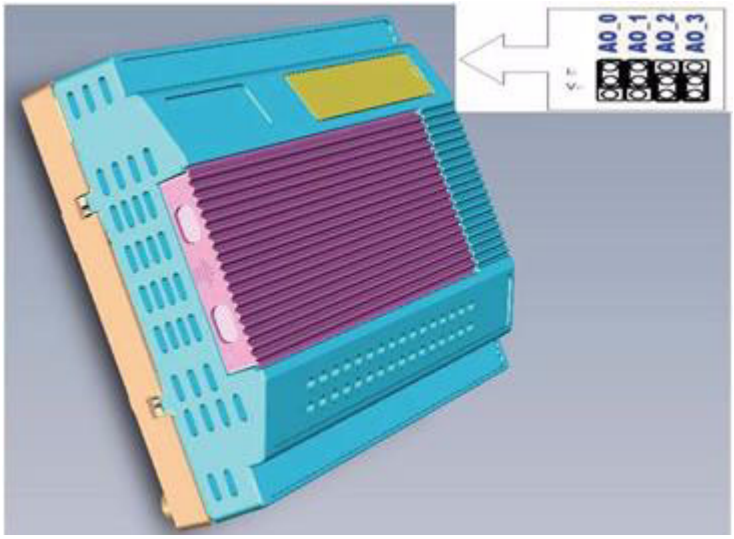
Note! *Local Bus only for AdvanTech product use.*

2. Set the MAC Address: Use screwdriver to open right-upper cover to configure the MAC Address by turn DIP SW1 and SW2 (SW1.1~4, SW2 1~3, total 7 bit, MAC Address range 1..127). SW1.1 is lowest bit, SW2.3 is highest bit, SW2.4 is reserved. Example: 1_0_0_0_0_0_0_1 means MAC Address is 1, please refer bellow table for another MAC Address.



SW1(1_2_3_4)_SW2(1_2_3_4)	MAC Address
0_0_0_0_0_0_0_0	0
1_0_0_0_0_0_0_0	1
0_1_0_0_0_0_0_0	2
1_1_0_0_0_0_0_0	3
0_0_1_0_0_0_0_0	4
1_1_1_1_1_1_1_0	127
1_0_0_0_0_0_0_1	1
0_1_0_0_0_0_0_1	2
1_1_1_1_1_1_1_1	127

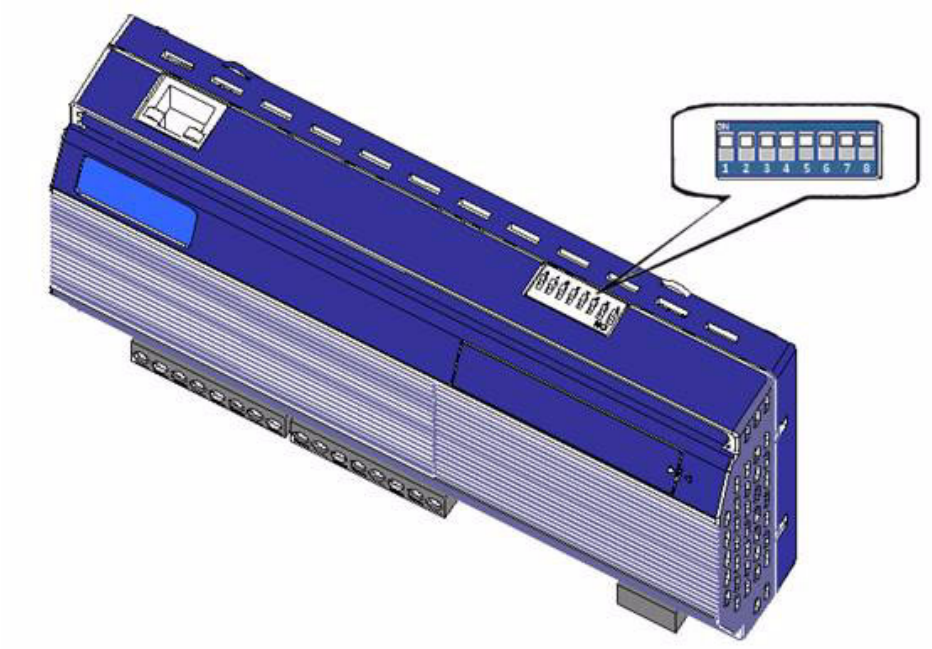
3. Set signal type of Analog output: Use screwdriver to open right-upper cover to set signal type of Analog output by jumpers located on DIP left side. Please refer to below figure to set signal type of each channel as V or I.



4. Set signal type of Universal input: For Current input, please connect extra 125 ohm resistor on UI terminal block.
5. Connect RS-485 with PC or other IO module on network: Please use twist-pair with shielding cable to connect “Data+” and “Data-” terminal block of this IO module to next IO module or PC or DDC controller with BACnet MS/TP.

3.2 DDC Module (BAS-3500BC)

1. DDC Module (BAS-3500BC)
   Set the MAC Address: (Default is 0, all off)
   If user has many DDCs in application please turn SW3 switch on/off for the MAC Address selection which defined as below table.



MAC Address range is from 0 to 255. SW1.1 is lowest bit, SW1.8 is highest bit.

Example: 1_0_0_0_0_0_0_0 means MAC Address is 1, please refer bellow table for another MAC Address.

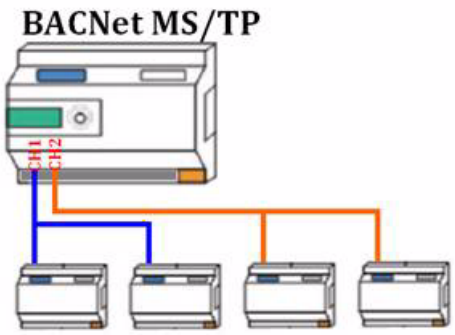
SW3 _1_2_3_4_5_6_7_8	MAC Address
0_0_0_0_0_0_0_0 (Default)	0
1_0_0_0_0_0_0_0	1
0_1_0_0_0_0_0_0	2
1_0_0_0_0_0_1_1	193
1_1_1_0_0_1_1_1	231

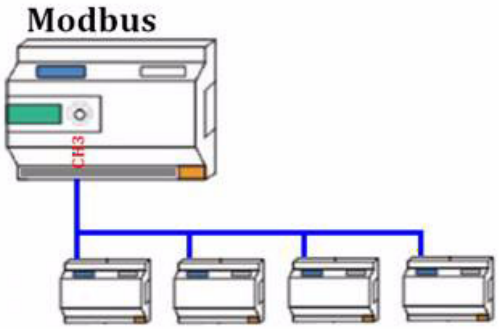
3.3 DDC and Remote I/O Module Installation Diagram

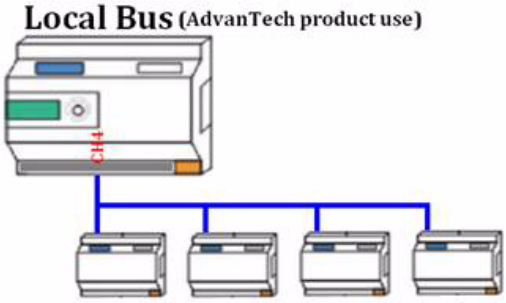
When user first time get s BAS-3000BC series modules, please note that new BAS-3000BC series modules will have default factory settings with MAC Address setting 0, and data format 9600, N, 8, 1. Redefine the address to avoid ID conflict if two or more new modules are used in the same network. Detail information of Domain Focused Configuration Tool please refer to Chapter 4.1.

Communication

- COM1: RS-485 BACnet MS/TP
- COM2: RS-485 BACnet MS/TP
- COM3: RS-485 Modbus RTU Master
- COM4: RS-485 Local Bus (AdvanTech product use)







Chapter 4

Domain Focused Config Tool

4.1 Domain Focused Configuration Tool

Advantech Domain Focused Configuration Tool is a BACnet Utility specially designed for Building Automation, and is a powerful graphical configuration tool. After some simple training, general engineering technicians will be able to configure their Advantech BACnet30XXBC I/O module series with Advantech Domain Focused Configuration Tool easily, this will greatly reduce the cost of project development and shorten the development cycle.

Advantech Domain Focused Configuration Tool is a utility tool which is for configuring respective parameters of I/O & communication and setting Device Instance and MAC ID of BAS-30XXBC BACNet IO modules. Hardware connection is shown as below:

Requirements

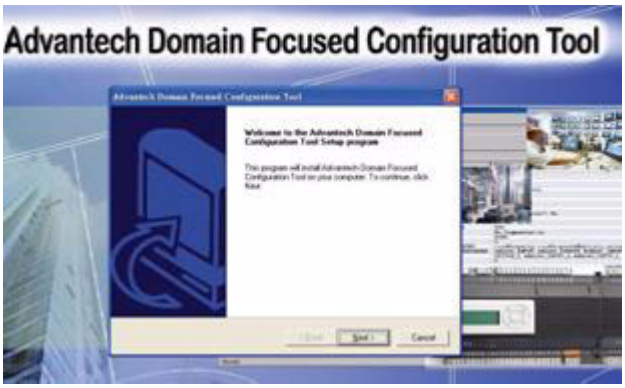
- Hardware: BAS- 3000BC Series remote I/O module
- Operating System: Microsoft Windows XP
- Com Interface: Standard serial COM port and EIA232-485 converter or USB to RS-485 converter

4.2 Domain Focused Configuration Tool Usage

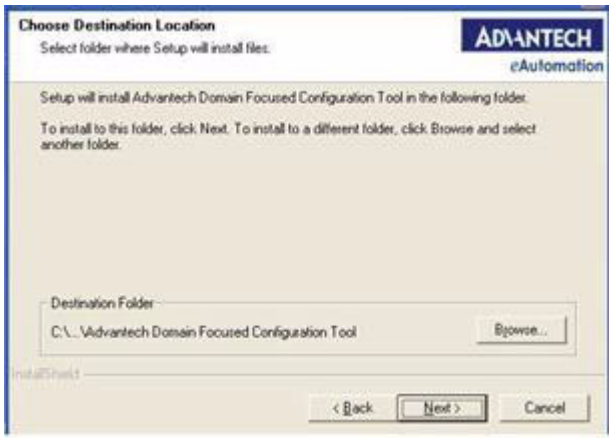
4.2.1 Installation Procedure

First, insert the CD into your CD-ROM Drive, then run Advantech Domain Focused Configuration Tool on your CD to start install Shield Wizard. It will guide you through the installation.

1. Run Advantech Domain Focused Configuration Tool Setup.exe, and the following message appears:

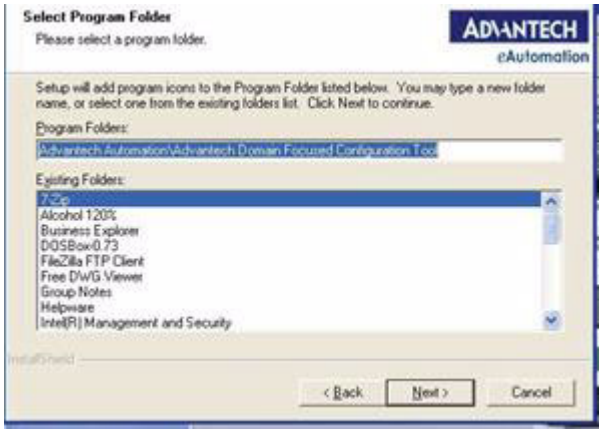


2. Click "Next", and the following message appears:

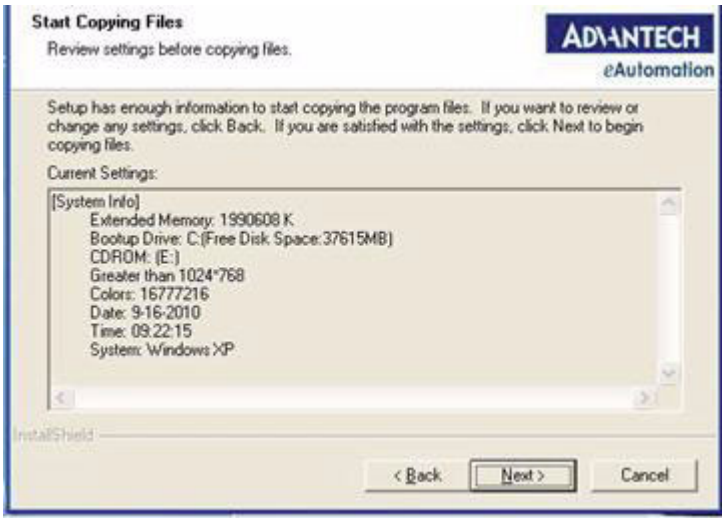

Choose Destination Location
Select folder where Setup will install files.
ADVANTECH
eAutomation
Setup will install Advantech Domain Focused Configuration Tool in the following folder.
To install to this folder, click Next. To install to a different folder, click Browse and select another folder.
Destination Folder
C:\...\Advantech Domain Focused Configuration Tool
Browse...
< Back
Next >
Cancel

The default installation path is: C:\Program Files\Advantech\Advantech Domain Focused Configuration Tool Utility. You can click "Browse" to change the installation path.

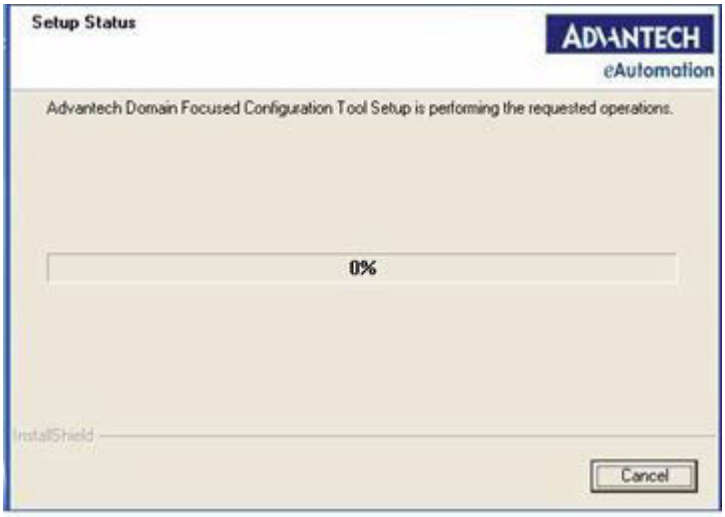
3. Click "Next", and the following message appears:



4. Click "Next", and the following message will appear:


Start Copying Files
Review settings before copying files.
ADVANTECH
eAutomation
Setup has enough information to start copying the program files. If you want to review or change any settings, click Back. If you are satisfied with the settings, click Next to begin copying files.
Current Settings:
[System Info]
Extended Memory: 1990608 K
Bootup Drive: C:(Free Disk Space:37615MB)
CDROM: (E:)
Greater than 1024*768
Colors: 16777216
Date: 9-16-2010
Time: 09:22:15
System: Windows XP
InstallShield
< Back
Next >
Cancel

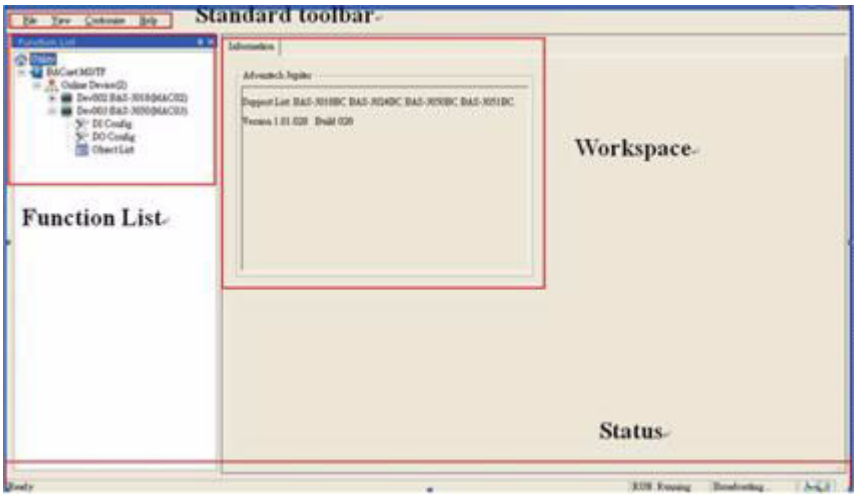
5. Click "Next", and the software will automatically finish the installation.



After you have installed the software properly, it will appear in the start menu show as below

4.2.2 Software Usage

Advantech Domain Focused Configuration Tool consists of the following parts: standard toolbar, function list block, status block and workspace block.



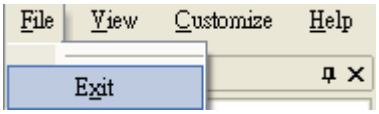
- Standard toolbar area: menu bar selection
- Function list area: BACnet device and object tree
- Workspace area: configure the property of BACnet objects
- Status area: system status bar where current status, running mode and which module in use can be viewed.

To start Advantech Domain Focused Configuration Tool, please double-click Advantech Domain Focused Configuration Tool icon on the desktop or from the Windows Program Group.

4.2.2.1 Standard Toolbar

File:

When you want to exit program, you can click File -> Exit, then you exit Advantech Domain Focused Configuration Tool tool.



View:

No.	Sub Items	Description
1	Status Bar	Show or hide the Status Bar in the program window.
2	Functions	Show or hide the function list zone in the program window.

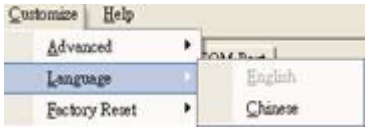
Customize:

The pull down list of the Customize includes four sub items:

AdvanceD:

It can change general user setting or advance user setting in Advantech Domain Focused Configuration Tool, default is general user setting.

Language:



No.	Sub Items	Description
1	English	Displays Advantech Domain Focused Configuration Tool user interface in English.
2	Chinese	Displays Advantech Domain Focused Configuration Tool user interface in Chinese.

Factory Reset:

It can restore default setting when press it.

Help:

The help has two sub items: About Advantech Domain Focused Configuration Tool and Help.

About Advantech Domain Focused Configuration Tool:

When the user clicks About Advantech Domain Focused Configuration Tool, the software edition appears.

When users click Help, the online help file appears.

4.2.2.2 Status

At the bottom of the program window is the system status bar, through which the current status, running mode and which module in use can be viewed.

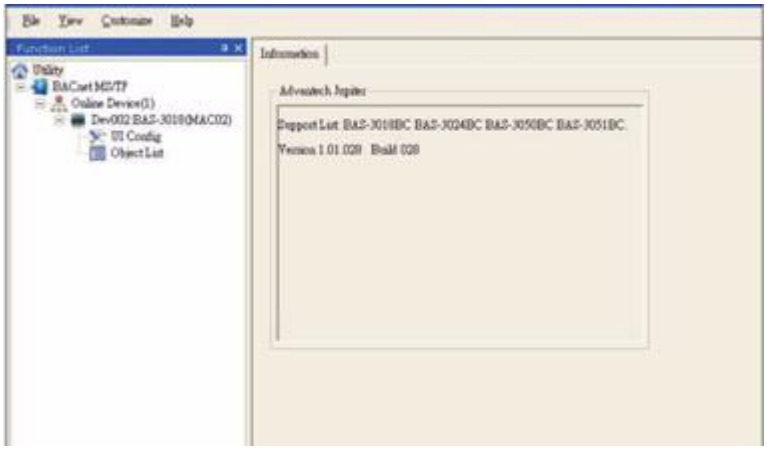
4.3 Hardware Operation

Advantech Domain Focused Configuration Tool are designed for configure BAS-30XXBC Remote I/O module. The management of devices is also provided in this chapter.

4.3.1 Device Management

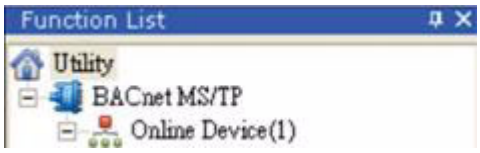
4.3.1.1 System Information

You can click mouse on [Advantech Domain Focused Configuration Tool], it will show information.

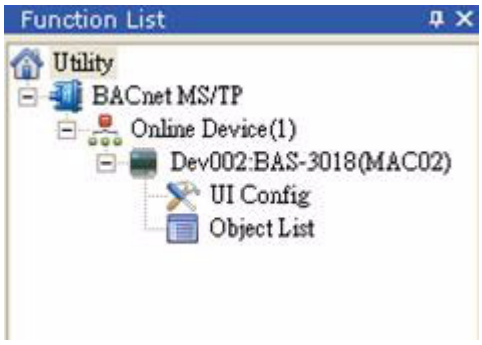


4.3.1.2 Auto Scan

Advantech Domain Focused Configuration Tool provides an automatic scan function for the BAS-30xxBC Remote IO module series. The user can select [Online Device] to scan IO modules which are working normally.

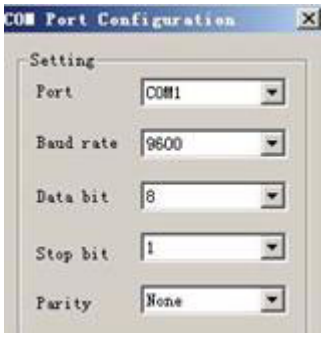


After it scans the device, it will show on bellow:

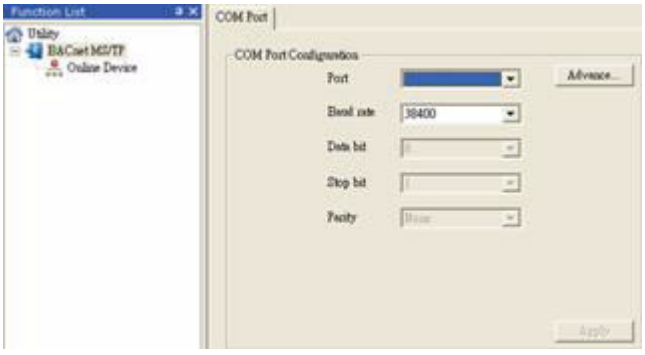


In the default state, the setting of PC serial port is: Port = COM1 (Base on user's define), Baud Rate = 9600, Data Bit = 8, Stop Bit = 1, Parity Check = None.

Data Bit, Stop Bit and Parity Check is gray out in default setting. If you want to tune in detail, users can select to Advance User Setting in user menu bar.



If the user wants to re-configure, please click the [BACnet MS/TP] button:



If we select [Advance], we can set item [This Station] and [Device Instance].

"This Station" the MAC address of this node. TS is generally read from a hardware DIP switch, or from nonvolatile memory. Valid values for TS are 0 to 254. The value 255 is used to denote broadcast when used as a destination address but is not allowed as a value for TS.

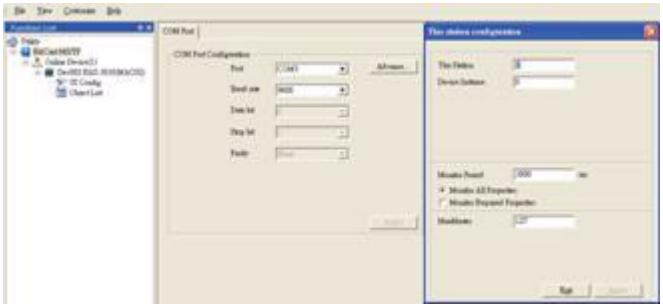
Device Instance: It is identifier in BACnet standard.

4.3.1.3 Advance Auto-Scan Setting

We can setup our utility in advance setting when we select [Customize] -> [Advance] -> [Advance User] in utility menu bar.

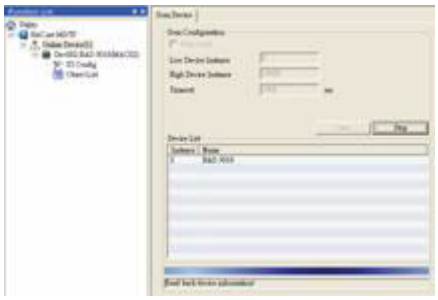
In advance user setting:

When users select [Advance], you can configure your advance scanning setting.



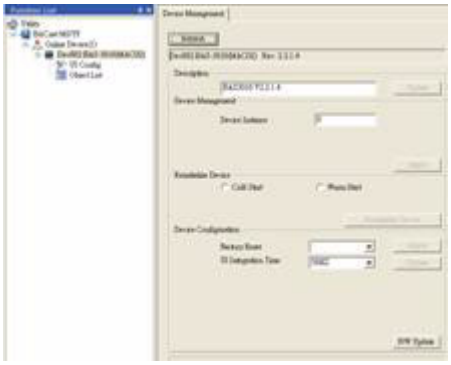
In Online Device:

We can select more setting when we run auto-scan on our I/O device.



4.3.2 Connection Device Information

After utility search we can see Dev 3: BAS-3050 and find out our I/O and object properties in device that show under [Online Device] as below.



Description: Device version information.

Default Device Instance = MAC address, after customer modify Device Instance value, and this new value would be the new Device Instance. BAS-30xxBC module type is set as Master-Slave Mode. MAC address range is 0~127; Device Instance address range is 0~4194302.

Reinitialize Device:

In cold start and warm start,

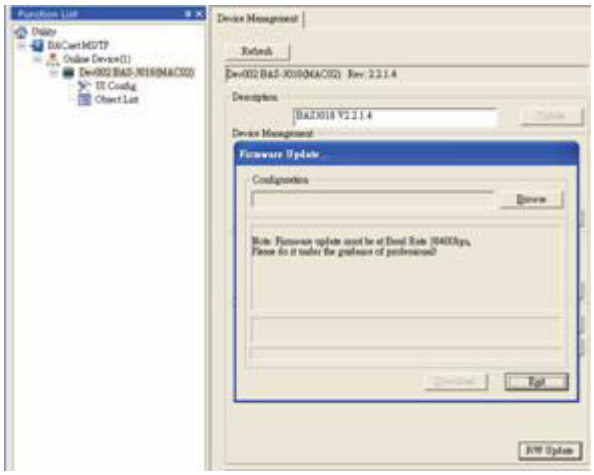
Cold Start	Reboot itself
Warm Start	Reset itself to some predefined initial state

NO.	Item		Cold Start	Warm Start	power off/restart
1	DI	counter/freq	According auto-start or not to decide auto frequency counting or not.	No effect	According auto-start or not to decide auto frequency counting or not.
2	DI	normal	No effect	No effect	No effect
3	DO	normal	According keep last value to decide clean output value or not	Output value not effect	Output default value
4	DO	PWM	Period is 1s, then duty cycle is 50%,PWM output is stop	No effect	Period is 1s, then duty cycle is 50%,PWM output is stop
5	AI	value	No effect	No effect	No effect
6	AO	value	According keep last value to decide keep output value as default value or not	Output value not effect	Output default value
7	BACnet	MAC and device instance	Update value	Update value	Update value
8	HW Setting	UART setting	Update value	Update value	Update value

4.3.3 Firmware Updates

All our I/O modules (BAS-3018BC / BAS-3024BC / BAS-3050BC / Bas-3051BC) have same step to update newly version firmware. Remember that Baud rate must set 384,00bps

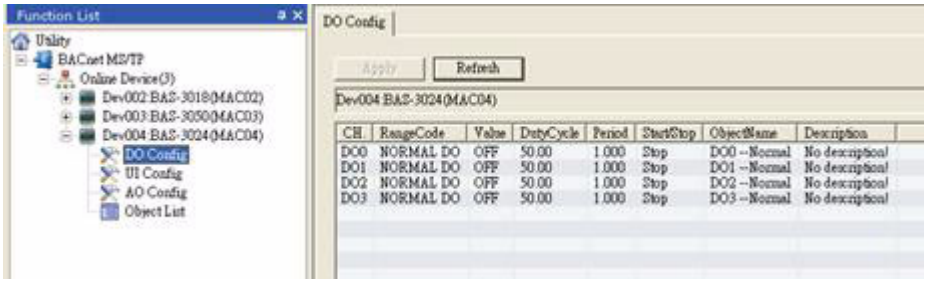
1. Go to Dev page, you can choose [F/W Update] to update your new version firmware.



If your baud rate not set on 38400bps, system will pop out warning message

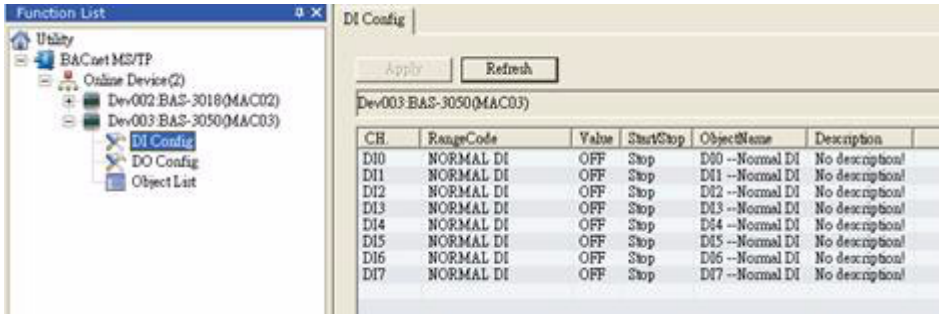
4.4 Hardware Parameter Configuration

After Utility auto-scanned and found out I/O device, you can see device property in [Dev no. : I/O Module]. There are four type channel DI, DO, UI, AO that can find in our BAS-30XXBC I/O module. Take BAS-3024BC for example. We can see utility found out BAS-3024BC and it has DO channel configuration, UI channel configuration, AO channel configuration and Object List.



4.4.1 DI Configuration

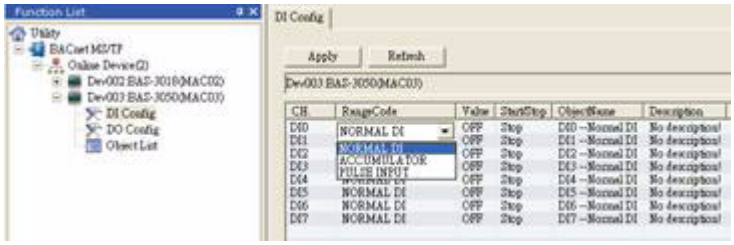
You can choose the “DI Config” in Function List to configure all digital input channels settings.


Function List
Utility
BACnet MS/TP
Online Device(2)
Dev002:BAS-3018(MAC02)
Dev003:BAS-3050(MAC03)
DI Config
DO Config
Object List
DI Config
Apply
Refresh
Dev003:BAS-3050(MAC03)
CH. RangeCode Value StartStop ObjectName Description
DI0 NORMAL DI OFF Stop DI0 --Normal DI No description!
DI1 NORMAL DI OFF Stop DI1 --Normal DI No description!
DI2 NORMAL DI OFF Stop DI2 --Normal DI No description!
DI3 NORMAL DI OFF Stop DI3 --Normal DI No description!
DI4 NORMAL DI OFF Stop DI4 --Normal DI No description!
DI5 NORMAL DI OFF Stop DI5 --Normal DI No description!
DI6 NORMAL DI OFF Stop DI6 --Normal DI No description!
DI7 NORMAL DI OFF Stop DI7 --Normal DI No description!

DI property table

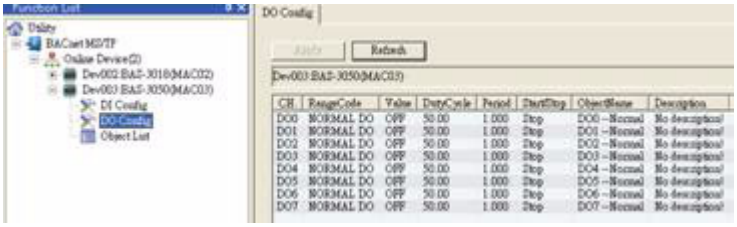
Channel	Digital input port number
RangeCode	You can choose “DI”, “Accumulator” or “Pulse Input”. When you choose “Accumulator”, the digital input channel will count the pulse number of the input signal. When you choose “Pulse”, the digital input channel will read input signal frequency. Noted: Just support two channels as Pulse input or Accumulator
Value	Active or Inactive
Start/Stop	Start / Stop
ObjectName	Object name
Description	Description

Take BAS-3050BC for example. User can select RangeCode to select what input type they want and can edit the description of each channel each channel in [Description].



4.4.2 DO Configuration

You can choose the “DO Config” in Function List to configure all digital output channels settings.

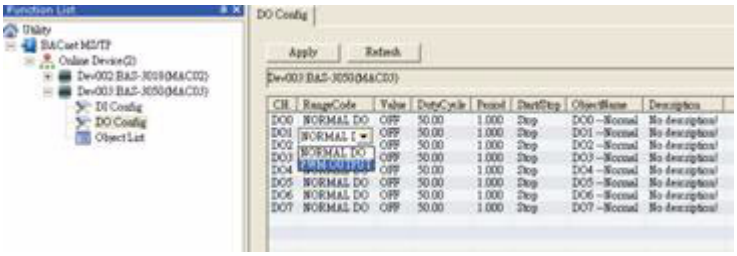


DO property table

Channel	Digital output port number
RangeCode	It is the same that you can choose the “DO” tab to configure all digital output channels settings. You can select the channel you want to configure by the “Channel” combo box, and then choose the correct input type by the “Output Range” combo box. You can choose “Normal” or “PWM Output”. Note: Just support two channels as PWM. When you choose “PWM Output”, you can click the “PWM test” to define the duty cycle and period. When you complete the setting, click the “OK” button. After you have completed the setting for the specific channel, click the “Apply” button to save the setting.
Value	On or Off
Duty Cycle	When function code is PWM, set duty cycle parameter(0.1~100) percent.

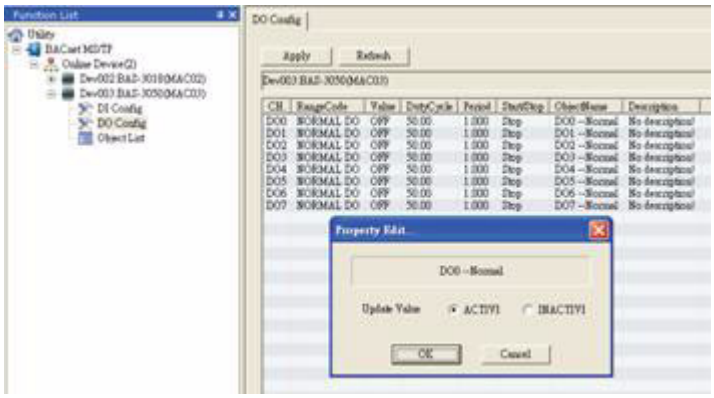
Period	When function code is PWM, set period parameter(0.002~3600) second.
Start/Stop	Start / Stop
ObjectName	Object name
Description	Description

Take BAS-3050BC for example.



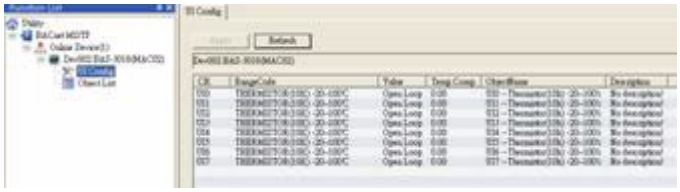
Besides, you can change the digital output channel value in the DO [Value].

Select the channel you want to control and click related “Output” button. A [Value] window will pop-up and you can choose the value by “Active” or “Inactive” radio button. After you choose the value, click the “OK” button to complete. PWM relative such as parameters edit.



4.4.3 UI Configuration

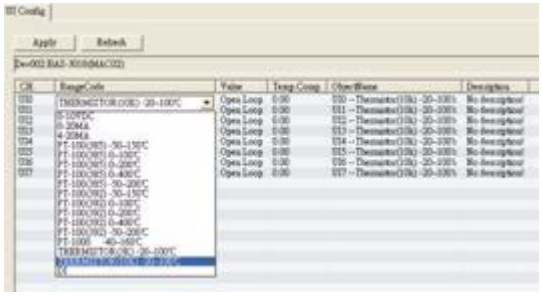
You can choose the “UI” tab to configure all universal input channels settings.



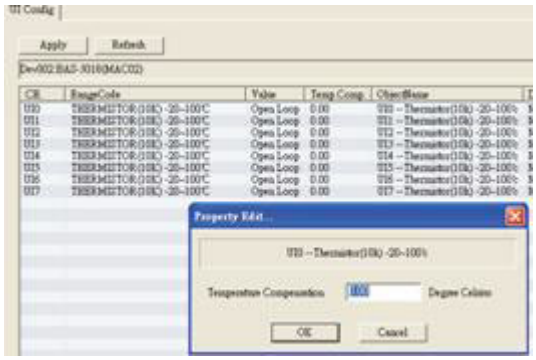
UI property table

Channel	Universal Input port number
RangeCode	You can choose the “UI” tab to configure all universal input channels settings. You can select the channel you want to configure by the “Channel” combo box, and then choose the correct input type by the “Input Range” combo box. There are several different input types you can choose: voltage, current, RTD, Thermistor and digital input (DI). When you choose RTD or Thermistor input type, you can use “Temperature Compensation” text box to correct the temperature value by considering the lead resistance. After you have completed the setting for the specific channel, click the “Apply” button to save the setting. You can select as bellow: UI Input signal is 0 ~ 20ma UI Input signal is 4 ~ 20ma UV10 Input signal is 0 ~ 10V PT100_A Input signal is PT100-385 Measuring range is -50'C ~ 150'C PT100_B Input signal is PT100-385 Measuring range is 0'C ~ 100'C PT100_C Input signal is PT100-385 Measuring range is 0'C ~ 200'C PT100_D Input signal is PT100-385 Measuring range is 0'C ~ 400'C PT100_E Input signal is PT100-385 Measuring range is -50'C ~ 200'C PT100_F Input signal is PT100-392 Measuring range is -50'C ~ 150'C PT100_G Input signal is PT100-392 Measuring range is 0'C ~ 100'C PT100_H Input signal is PT100-392 Measuring range is 0'C ~ 200'C PT100_I Input signal is PT100-392 Measuring range is 0'C ~ 400'C PT100_J Input signal is PT100-392 Measuring range is -50'C ~ 200'C PT1000_A Input signal is PT1000 Measuring range is -40'C ~ 160'C Thermistor_3k Input signal is Thermistor 3k Measuring range is -20'C ~ 100'C Thermistor_10k Input signal is Thermistor 10k Measuring range is -20'C ~ 100'C UDI Input signal is Normal DI
TempCompensation	Temperature compensate
Start/Stop	Start / Stop
ObjectName	Object name
Description	Description

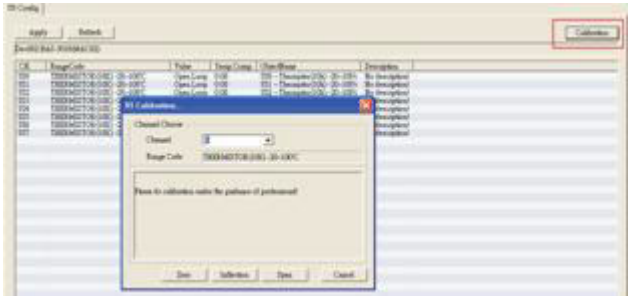
Take BAS-3018BC for example



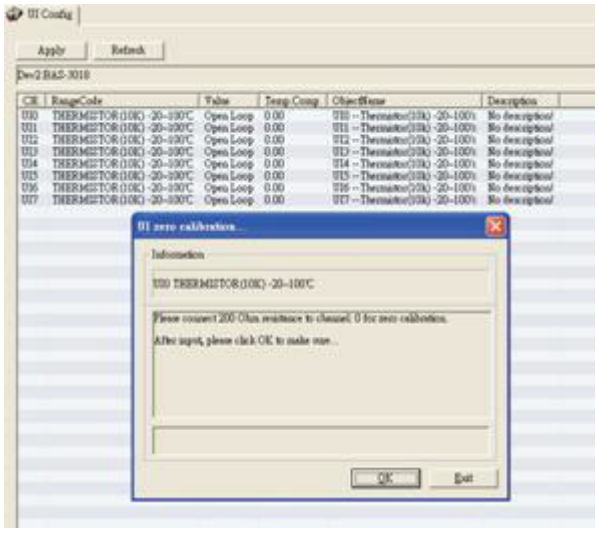
When you choose RTD or Thermistor input type, you can use [Temperature Compensation] to correct the temperature value by considering the lead resistance. After you have completed the setting for the specific channel, click the “Apply” button to save the setting.



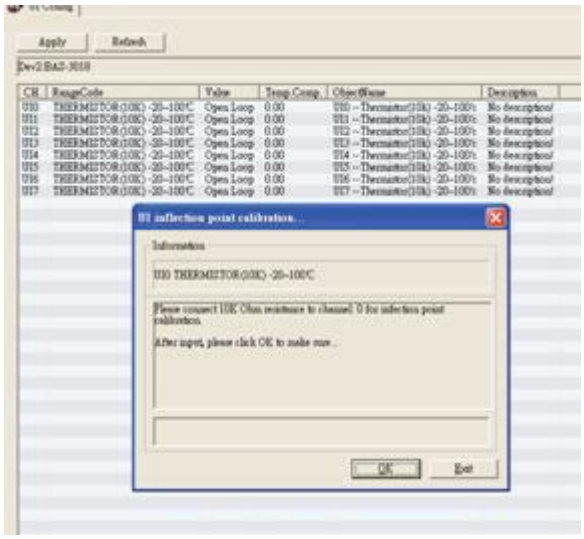
Besides, you also can perform span calibration and zero calibration by clicking the [Calibration] on right up side, then click button and pop-up window, you can select “Zero Calibration” or “Span Calibration”.



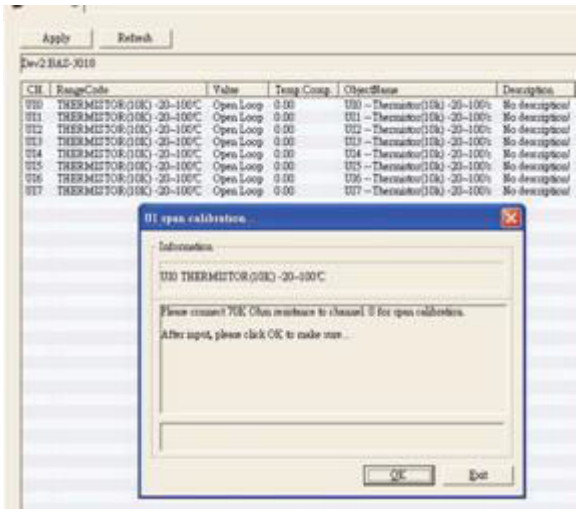
Zero Calibration:



Inflection Calibration



Span Calibration



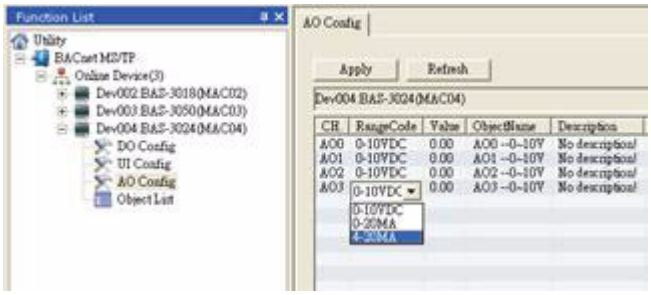
4.4.4 AO Configuration

You can choose the “AO” tab to configure all analog output channels settings.

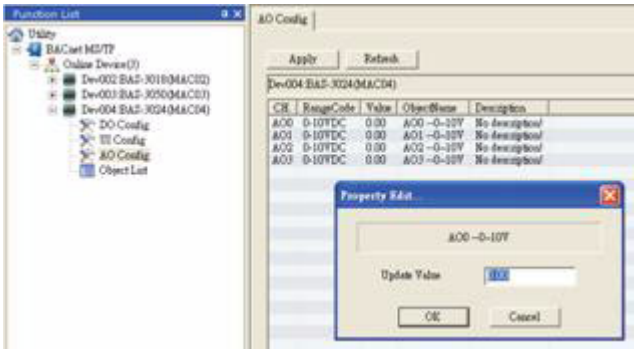
AO property table

Channel	Analog output port number
RangeCode	You can choose the “AO” tab to configure all analog output channels settings. You can select the channel you want to configure by the “Channel” combo box, and then choose the correct input type by the “Output Range” combo box. You can choose voltage or current. After you have completed the setting for the specific channel, click the “Apply” button to save the setting.
Value	Value
ObjectName	Object name
Description	Description

Take BAS-3024BC for example



You can change analog output value in the [Value]. Select the channel you want to control and click [Value] button. A “Update Value” window will pop-up and you can enter the value in the text box. After you choose the value, click the “OK” button to complete.



4.5 Object List of Each Module

The BACnet standard identifies define more than 123 different Properties of Objects now. A different subset of these Properties is specified for each type of Object. BACnet is different from traditional industry conventions with its object-oriented structured. The industry has long used the general-purpose term "points", which could refer to sensor inputs, control outputs or control values, with different characteristics according to manufacturer. BACnet instead defines a standard set of "Objects", each of which has a standard set of "Properties"; that describe the Object and its current status to other devices on the BACnet internetwork. It is through these properties that the Object may be controlled by other BACnet devices.[1]

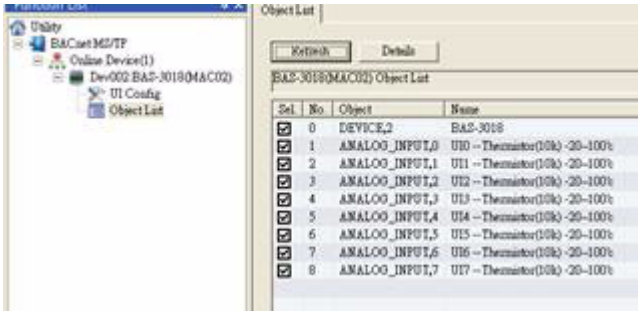
This section mainly introduces how to manipulate parameters of the device through modifying properties of AI, AO, BI and BO objects.

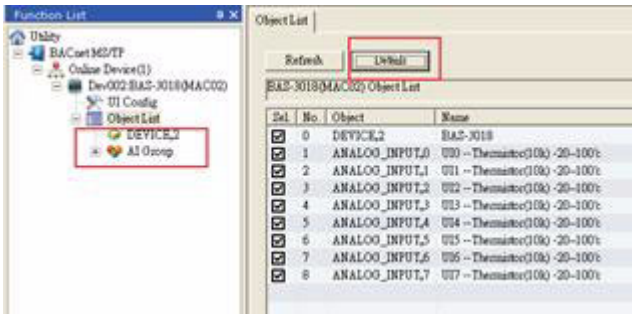
Range and data type of the objects are as below:

Object	Range	Data type
AI	ALL	Real
AO	ALL	Real
BI	ALL	Enumerated
BO	ALL	Enumerated

Remark: [1]. http://www.bacnet.org/Bibliography/ES-7-96/ES-7-96.htm

Users can select [Object List] in Function List, press [detail] and Object will pop-out DEVICE object and Object groups in Function List.





4.5.1 AI Object Property

The Analog Input object type defines a standardized object whose properties represent the externally visible characteristics of an analog input. Bellow is AI object properties table. More detail you can reference in BACnet Standard.

Object_Identifier	This property, of type BACnetObjectIdentifier, is a numeric code that is used to identify the object. It shall be unique within the BACnet Device that maintains it.
Object_Name	This property, of type CharacterString, shall represent a name for the object that is unique within the BACnet Device that maintains it. The minimum length of the string shall be one character. The set of characters used in the Object_Name shall be restricted to printable characters.
Object_Type	This property, of type BACnetObjectType, indicates membership in a particular object type class. The value of this property shall be ANALOG_INPUT.
Present Value	This property, of type REAL, indicates the current value, in engineering units, of the input being measured. The Present_Value property shall be writable when Out_Of_Service is TRUE.
Description	This property, of type CharacterString, is a string of printable characters whose content is not restricted.
Status_Flags	This property, of type BACnetStatusFlags, represents four Boolean flags that indicate the general "health" of an analog input. The four flags are {IN_ALARM, FAULT, OVERRIDDEN, OUT_OF_SERVICE}
Event_State	The Event_State property, of type BACnetEventState, is included in order to provide a way to determine if this object has an active event state associated with it. If the object supports intrinsic reporting, then the Event_State property shall indicate the event state of the object. If the object does not support intrinsic reporting, then the value of this property shall be NORMAL.
Out_Of_Service	The Out_Of_Service property, of type BOOLEAN, is an indication whether (TRUE) or not (FALSE) the physical input that the object represents is not in service. This means that the Present_Value property is decoupled from the physical input and will not track changes to the physical input when the value of Out_Of_Service is TRUE.
Units	This property, of type BACnetEngineeringUnits, indicates the measurement units of this object. See the BACnetEngineeringUnits ASN.1 production in Clause 21 for a list of engineering units defined by this standard.
RANGECODE_CONFIG	Range Code setting in AI Object.
TEMPERATURECOMPENSATION_VALUE	Value setting in temperature compensation
ZEROCALIBRATION_CMD	Write this property ‘0xff” start AI zero calibration Read this property ,return zero calibration data
SPANCALIBRATION_CMD	Write this property ‘0xff” start AI span calibration Read this property ,return span calibration data.

4.5.1.1 RANGECODE_CONFIG IN AI

Modify value of AI function code as below:

- UI Input signal is 0~20ma
- UI Input signal is 4~20ma
- UV10 Input signal is 0~10V
- PT100_A Input signal is PT100-385 Measuring range is -50~150° C
- PT100_B Input signal is PT100-385 Measuring range is 0~100° C
- PT100_C Input signal is PT100-385 Measuring range is 0~200° C
- PT100_D Input signal is PT100-385 Measuring range is 0~400° C
- PT100_E Input signal is PT100-385 Measuring range is -50~200° C
- PT100_F Input signal is PT100-392 Measuring range is -50~150° C
- PT100_G Input signal is PT100-392 Measuring range is 0~100° C
- PT100_H Input signal is PT100-392 Measuring range is 0~200° C
- PT100_I Input signal is PT100-392 Measuring range is 0~400° C
- PT100_J Input signal is PT100-392 Measuring range is -50~200° C
- PT1000_A Input signal is PT1000 Measuring range is -40~160° C
- Thermistor_3k Input signal is Thermistor 3k Measuring range is -20~100° C
- Thermistor_10k Input signal is Thermistor 10k Measuring range is -20~100° C
- UDI Input signal is Normal DI

4.5.2 AO Object Property

The Analog Output object type defines a standardized object whose properties represent the externally visible characteristics of an analog output. Bellow is AO object properties table. More detail you can reference in BACnet Standard.

Object_Identifier	This property, of type BACnetObjectIdentifier, is a numeric code that is used to identify the object. It shall be unique within the BACnet Device that maintains it.
Object_Name	This property, of type CharacterString, shall represent a name for the object that is unique within the BACnet Device that maintains it. The minimum length of the string shall be one character.
Object_Type	This property, of type BACnet Object Type, indicates membership in a particular object type class. The value of this property shall be ANALOG_OUTPUT..
Description	This property, of type Character String, is a string of printable characters whose content is not restricted..
Present Value	This property, of type REAL, indicates the current value, in engineering units, of the output.
Status_Flags	This property, of type BACnetStatusFlags, represents four Boolean flags that indicate the general "health" of an analog output. Three of the flags are associated with the values of other properties of this object. A more detailed status could be determined by reading the properties that are linked to these flags. The relationship between individual flags is not defined by the protocol. The four flags are {IN_ALARM, FAULT, OVERRIDDEN, OUT_OF_SERVICE}
Event_State	The Event_State property, of type BACnetEventState, is included in order to provide a way to determine if this object has an active event state associated with it. If the object supports intrinsic reporting, then the Event_State property shall indicate the event state of the object. If the object does not support intrinsic reporting, then the value of this property shall be NORMAL.
Out_Of_Service	The Out_Of_Service property, of type BOOLEAN, is an indication whether (TRUE) or not (FALSE) the physical point that the object represents is not in service. This means that changes to the Present_Value property are decoupled from the physical output when the value of Out_Of_Service is TRUE. While the Out_Of_Service property is TRUE, the Present_Value and Reliability properties may still be changed to any value as a means of simulating specific fixed conditions or for testing purposes. More you can reference in BACnet standard.
Units	This property, of type BACnetEngineeringUnits, indicates the measurement units of this object.
PRIORITY_ARRAY	This property is a read-only array of prioritized values.
RELINQUISH_DEFAULT	This property is the default value to be used for the Present_Value property when all command priority values in the Priority_Array property have a NULL value.
RANGECODE_CONFIG	Range Code setting in AO Object.
ZEROCALIBRATION_CMD	Write this property ‘0xff” start AI zero calibration Read this property ,return zero calibration data
SPANCALIBRATION_CMD	Write this property ‘0xff” start AI span calibration Read this property ,return span calibration data
KEEPLASTVALUE_CMD	Write this property to 1,then if reinitial device the value will be keep.

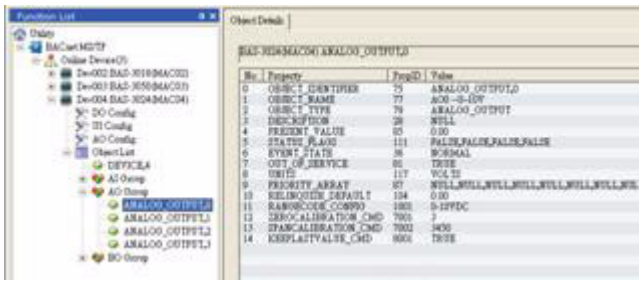
4.5.2.1 RANGECODE_CONFIG IN AO Object

Modify value of AO function code as below:

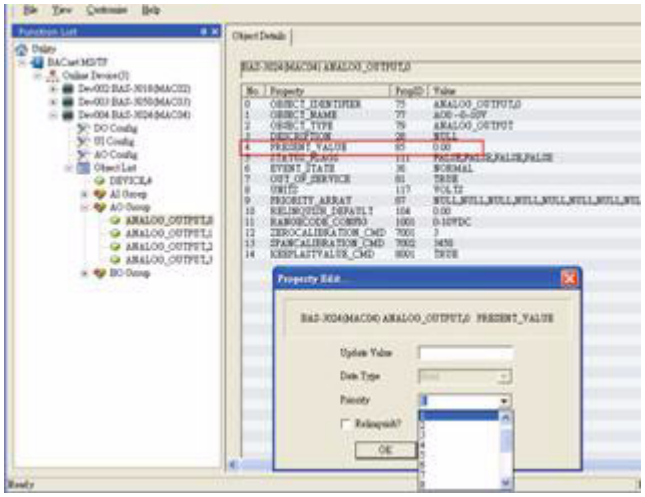
72: AO10 Input signal is 0~10 V

70: UI_A Input signal is 0~20 mA

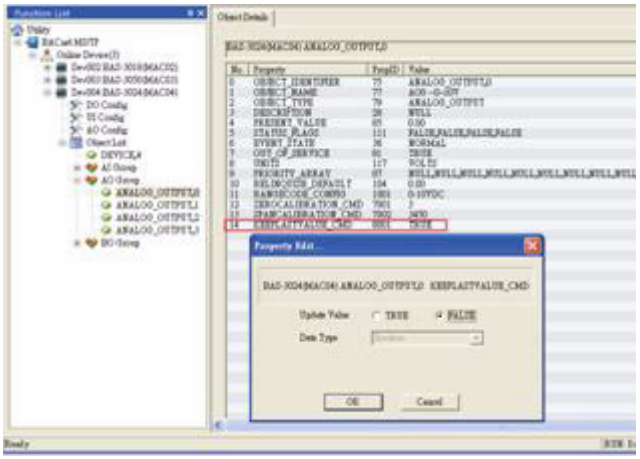
7: UI_B Input signal is 4~20 mA



User can change PRESENT_VALUE in AO object group.



User can change KEEPLASTVALUE_VALUE in AO object group.



4.5.3 BI Object Property

The Binary Input object type defines a standardized object whose properties represent the externally visible characteristics of a binary input. A "binary input" is a physical device or hardware input that can be in only one of two distinct states. Bellow is BI object properties table. More detail you can reference in BACnet Standard.

Object_Identifier	This property, is a numeric code that is used to identify the object. It shall be unique within the BACnet Device that maintains it.
Object_Name	This property, of type CharacterString, shall represent a name for the object that is unique within the BACnet Device that maintains it. The minimum length of the string shall be one character.
Object_Type	This property indicates membership in a particular object-type class. The value of this property shall be BINARY_INPUT.
Present Value	This property reflects the logical state of the Binary Input. The logical state of the Input shall be either INACTIVE or ACTIVE. More detail can reference in BACnet Standard.
Description	This property, of type Character String, is a string of printable characters whose content is not restricted.
Status_Flags	This property represents four Boolean flags that indicate the general "health" of a binary input. Three of the flags are associated with the values of other properties of this object. A more detailed status could be determined by reading the properties that are linked to these flags. The relationship between individual flags is not defined by the protocol. The four flags are {IN_ALARM, FAULT, OVERRIDDEN, OUT_OF_SERVICE}
Event_State	The Event_State property, of type BACnetEventState, is included in order to provide a way to determine if this object has an active event state associated with it. If the object supports intrinsic reporting, then the Event_State property shall indicate the event state of the object. If the object does not support intrinsic reporting, then the value of this property shall be NORMAL.
Out_Of_Service	The Out_Of_Service property, of type BOOLEAN, is an indication whether (TRUE) or not (FALSE) the physical input the object represents is not in service. This means that the Present_Value property is decoupled from the physical input and will not track changes to the physical input when the value of Out_Of_Service is TRUE. More detail can reference standard.
POLARITY	The relationship between the physical state of the Input and the logical state represented by the Present_Value property. If the Polarity property is NORMAL, then the ACTIVE state of the Present_Value property is also the ACTIVE or ON state of the physical Input as long as Out_Of_Service is FALSE. If the Polarity property is REVERSE, then the ACTIVE state of the Present_Value property is the INACTIVE or OFF state of the physical Input as long as Out_Of_Service is FALSE.
RANGECODE_CONFIG	Modify value of DI function code as below: 0：Normal_DI 256：counter 512：frequency
ACCUMULATION_VALUE	Read-only command: Integer data records count of input pulse (0~4294967296)
PULSEINPUT_VALUE	Read-only command: Floating point data records frequency value (less than 1 K)
STARTSTOP_CMD	When function code is counter or frequency , turn on/off running, Other function code read this property will be always ‘0’ 0: stop freq/count 1: start freq/count
AUTO_START	Auto start status.

4.5.3.1 RANGECODE_CONFIG

Modify value of DI function code as below:

0: Normal_DI

256: Counter

512: Frequency

4.5.4 BO Object Property

The Binary Output object type defines a standardized object whose properties represent the externally visible characteristics of a binary output. A "binary output" is a physical device or hardware output that can be in only one of two distinct states. In this description, those states are referred to as ACTIVE and INACTIVE. A typical use of a binary output is to switch a particular piece of mechanical equipment, such as a fan or pump, on or off. Bellow is BO object properties table. More detail you can reference in BACnet Standard.

Object_Identifier	This property, of type BACnetObjectIdentifier, is a numeric code that is used to identify the object. It shall be unique within the BACnet Device that maintains it.
Object_Name	This property, of type CharacterString, shall represent a name for the object that is unique within the BACnet Device that maintains it. The minimum length of the string shall be one character.
Object_Type	This property, of type BACnetObjectType, indicates membership in a particular object type class. The value of this property shall be BINARY_OUTPUT.
Present Value	This property, of type BACnetBinaryPV, reflects the logical state of the Binary Output. The logical state of the output shall be either INACTIVE or ACTIVE. The relationship between the Present_Value and the physical state of the output is determined by the Polarity property..
Description	This property, of type CharacterString, is a string of printable characters whose content is not restricted.
Status_Flags	This property, of type BACnetStatusFlags, represents four Boolean flags that indicate the general "health" of a binary output. Three of the flags are associated with the values of other properties of this object. A more detailed status could be determined by reading the properties that are linked to these flags. The relationship between individual flags is not defined by the protocol. The four flags are {IN_ALARM, FAULT, OVERRIDDEN, OUT_OF_SERVICE}

Event_State	The Event_State property, of type BACnetEventState, is included in order to provide a way to determine if this object has an active event state associated with it. If the object supports intrinsic reporting, then the Event_State property shall indicate the event state of the object. If the object does not support intrinsic reporting, then the value of this property shall be NORMAL.
Out_Of_Service	The Out_Of_Service property, of type BOOLEAN, is an indication whether (TRUE) or not (FALSE) the physical point the object represents is not in service. This means that changes to the Present_Value property are decoupled from the physical output when the value of Out_Of_Service is TRUE.
POLARITY	This property, of type BACnetPolarity, indicates the relationship between the physical state of the output and the logical state represented by the Present_Value property. If the Polarity property is NORMAL, then the ACTIVE state of the Present_Value property is also the ACTIVE or ON state of the physical output as long as Out_Of_Service is FALSE. If the Polarity property is REVERSE, then the ACTIVE state of the Present_Value property is the INACTIVE or OFF state of the physical output as long as Out_Of_Service is FALSE. More detail can reference BACnet standard.
PRIORITY_ARRAY	This property is a read-only array that contains prioritized commands that are in effect for this object.
RELINQUISH_DEFAULT	This property is the default value to be used for the Present_Value property when all command priority values in the Priority_Array property have a NULL value.
RANGECODE_CONFIG	Modify value of DO function code as below: 0:Normal DO 1: PWM
DUTYCYCLE_VALUE	When function code is PWM , set duty cycle parameter(0.1~100)
PERIOD_VALUE	When function code is PWM , set period parameter(0.002~3600)
STARTSTOP_CMD	When function code is PWM , turn on/off running, Other function code ,read this property will be always ‘0’ 0: stop DO PWM input 1: start DO PWM input
KEEPLASTVALUE_CMD	Write this property to 1,then if reinitial device , the value will be keep.

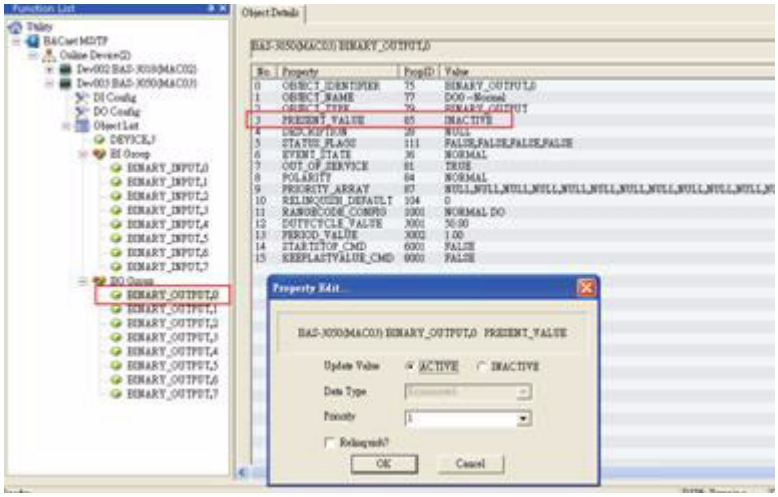
4.5.4.1 RANGECODE_CONFIG

Modify value of DO function code as below:

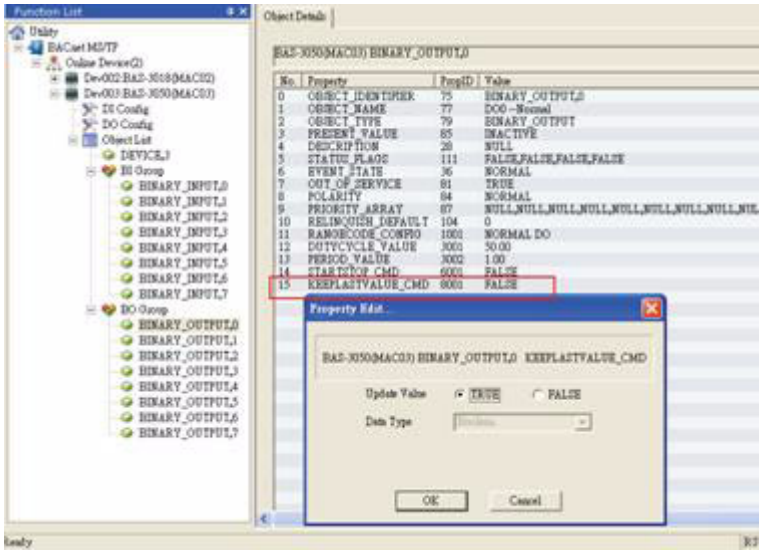
0:Normal DO

1: PWM

User can change PRESENT_VALUE in BO object group.



User can change KEEPLASTVALUE_CMD in BO object group.



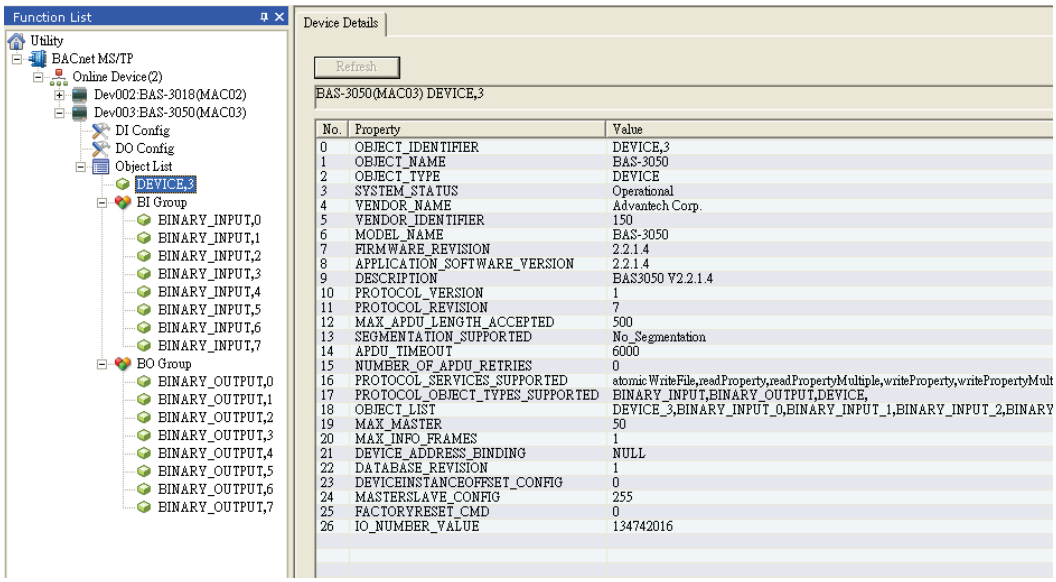
4.5.5 Device Object Property

The Device object type defines a standardized object whose properties represent the externally visible characteristics of a BACnet Device. There shall be exactly one Device object in each BACnet Device. A Device object is referenced by its Object_Identifier property, which is not only unique to the BACnet Device that maintains this object but is also unique throughout the BACnet internetwork. Bellow is Device object properties table. More detail you can reference in BACnet Standard.

Object_Identifier	This property, of type BACnetObjectIdentifier, is a numeric code that is used to identify the object. For the Device object, the object identifier shall be unique internetwork-wide.
Object_Name	This property, of type CharacterString, shall represent a name for the object that is unique internetwork-wide. The minimum length of the string shall be one character. The set of characters used in the Object_Name shall be restricted to printable characters.
Object_Type	This property, of type BACnetObjectType, indicates membership in a particular object type class. The value of this property shall be DEVICE.
SYSTEM_STATUS	This property, of type BACnetDeviceStatus, reflects the current physical and logical status of the BACnet Device. The values that may be taken on by this property are {OPERATIONAL,OPERATIONAL_READ_ONLY,DOWNLOAD_REQUIRED, DOWNLOAD_IN_PROGRESS, NON_OPERATIONAL, BACKUP_IN_PROGRESS}.
VENDER_NAME	This property, of type CharacterString, identifies the manufacturer of the BACnet Device
VENDOR_IDENTIFIER	This property, of type Unsigned16, is a unique vendor identification code, assigned by ASHRAE, which is used to distinguish proprietary extensions to the protocol.
MODEL_NAME	This property, of type CharacterString, is assigned by the vendor to represent the model of the BACnet Device
FIRMWARE_REVISION	This property, of type CharacterString, is assigned by the vendor to represent the level of firmware installed in the BACnet Device.
APPLICATION_SOFTWARE_VERSION	This property, of type CharacterString, identifies the version of application software installed in the machine. The content of this string is a local matter, but it could be a date-and-time stamp, a programmer's name, a host file version number, etc.
DESCRIPTION	This property, of type CharacterString, is a string of printable characters that may be used to describe the application being carried out by the BACnet Device or other locally desired descriptive information.
PROTOCOL_VERSION	This property, of type Unsigned, represents the version of the BACnet protocol supported by this BACnet Device. Every major revision of BACnet shall increase this version number by one. The initial release of BACnet shall be version 1.

PROTOCAL_REVISION	This property, of type Unsigned, shall indicate the minor revision level of the BACnet standard. This value shall start at 1 and be incremented for any substantive change(s) to the BACnet standard that affect device communication or behavior. This value shall revert to zero upon each change to the Protocol_Version property. Changes to the values for Protocol_Version and Protocol_Revision are recorded in the History of Revisions at the end of this standard. This property is required for all devices implementing BACnet Protocol_Version 1, Protocol_Revision 1 and above. Absence of this property shall indicate a device implemented to a version of the standard prior to the definition of the Protocol_Revision property.
MAX_APDU_LENGTH_ACCEPTED	This property, of type Unsigned, is the maximum number of octets that may be contained in a single, indivisible application layer protocol data unit. The value of this property shall be greater than or equal to 50. The value of this property is also constrained by the underlying data link technology.
SEGMENTATION_SUPPORTED	This property, of type BACnetSegmentation, indicates whether the BACnet Device supports segmentation of messages and, if so, whether it supports segmented transmission, reception, or both: {SEGMENTED_BOTH, SEGMENTED_TRANSMIT, SEGMENTED_RECEIVE, NO_SEGMENTATION}.
APDU_TIMEOUT	The APDU_Timeout property, of type Unsigned, shall indicate the amount of time in milliseconds between retransmissions of an APDU requiring acknowledgment for which no acknowledgment has been received. The default value for this property shall be 3,000 milliseconds for devices that permit modification of this parameter. Otherwise, the default value shall be 60,000 milliseconds. This value shall be non-zero if the Device object property called Number_Of_APDU_Retries is non-zero. In order to achieve reliable communication, it is recommended that the values of the APDU_Timeout properties of the Device objects of all intercommunicating devices should contain the same value.
NUMBER_OF_ADPU_RETRIES	The Number_Of_APDU_Retries property, of type Unsigned, shall indicate the maximum number of times that an APDU shall be retransmitted. The default value for this property shall be 3. If this device does not perform retries, then this property shall be set to zero. If the value of this property is greater than zero, a non-zero value shall be placed in the Device object APDU_Timeout property.
PROTOCAL_SERVICES_SUPPORTED	This property, of type BACnetServicesSupported, indicates which standardized protocol services are supported by this device's protocol implementation.
PROTOCAL_OBJECT_TYPES_SUPPORT	This property, of type BACnetObjectTypesSupported, indicates which standardized object types are supported by this device's protocol implementation.
OBJECT_LIST	This read only property is a BACnetARRAY of Object_Identifiers, one Object_Identifier for each object within the device that is accessible through BACnet services.
MAX_MASTER	The Max_Master property, of type Unsigned, shall be present if the device is a master node on an MS/TP network. The value of Max_Master specifies the highest possible address for master nodes and shall be less than or equal to 127. If the Max_Master property is not writeable via BACnet services, its value shall be 127.

MAX_INFO_FRAMES	The Max_Info_Frames property, of type Unsigned, shall be present if the device is a node on an MS/TP network. The value of Max_Info_Frames specifies the maximum number of information frames the node may send before it must pass the token. If Max_Info_Frames is not writable or otherwise user configurable, its value shall be one.
DEVICE_ADDRESS_BINDING	The Device_Address_Binding property is a List of BACnetAddress-Binding each of which consists of a BACnet Object_Identifier of a BACnet Device object and a BACnet device address in the form of a BACnetAddress. Entries in the list identify the actual device addresses that will be used when the remote device must be accessed via a BACnet service request. A value of zero shall be used for the network-number portion of BACnetAddress entries for other devices residing on the same network as this device.
DATABASE_REVISION	This property, of type Unsigned, is a logical revision number for the device's database. It is incremented when an object is created, an object is deleted, an object's name is changed, an object's Object_Identifier property is changed, or a restore is performed.
DEVICEINSTANCEOFFSET_CONFIG	Device instance offset setting.
FACTORYRESET_CMD	Reset to factory default set: 0x00: All channel reset 0x01:AI channel reset 0x02:AO channel reset 0x03:BI channel reset 0x04:BO channel reset
IO_NUMBER_VALUE	Read-only command: Return channel numbers Bit31~bit24:DI channel numbers Bit23~bit16:DO channel numbers Bit15~bit8:AI channel numbers Bit7~bit0:AO channel numbers



Chapter 5

Visual Testing Shell For BACnet

5.1 Introduction

Visual Test Shell (VTS) is an application for testing the BACnet functionality of various devices used in building automation systems. BACnet is a Data Communication Protocol for Building Automation and Control Networks developed under the auspices of the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE). VTS 3.0 has been turned into an open source project in the hopes that the users of this program will assist in making it a robust and full featured BACnet test tool. The home of the VTS 3.0 open source project is http://sourceforge.net/projects/vts/ .

Requirements for Testing with VTS

In order to test a device, the following basic components are needed:

1. The latest version of VTS 3, correctly installed on a PC (installation instructions are below). This constitutes the Testing Device (TD).
2. The device being tested, known as the Implementation Under Test (IUT), which must be on the same BACnet inter-network as the TD.

For testing with scripts, a formal description of the IUT called an Electronic Protocol Implementation Conformance Statement (EPICS) must be on the TD machine (see below).

5.2 Obtaining and Installing VTS

Step 1: Install WinPcap 4.0.1

1. Run the WinPcap installation program packaged with VTS. This program is named WinPcap_4_0_1.exe.
2. Follow the instructions on the screen. The installation applet will automatically detect the operating system and install the correct drivers.

If you later want to remove WinPcap from the system, go to the control-panel, click on "add/remove programs" and then select "WinPcap".

Step 2: Install VTS

VTS requires no installation. You may run it from the same directory where it was originally extracted from the zip archive. If you move VTS.EXE to a different directory, you must also move the file PTP.DLL to the same directory.

Step 3: Running VTS

- To run VTS 3:
- If you created a Desktop shortcut (in step 4 of the “To Install VTS” section), double-click the shortcut to start VTS.
- If you created a Start Menu command, click Start, then click the menu item to start VTS.
- Otherwise, use Windows Explorer to open the folder into which you extracted the VTS package and double-click on “VTS.exe”

5.3 Configuring VTS

The VTS Workspace

The collection of settings VTS uses to communicate with an IUT is called its workspace. The workspace includes information about the local device, communication ports and remote devices. Multiple workspaces can be created, to make it easier to use VTS to test multiple IUTs with different capabilities.

Three major components define the VTS workspace:

Device:

Device definitions allow users to use VTS to simulate BACnet devices. Each Device definition must define a local DEVICE object (for full details of the DEVICE object, see the BACnet standard (ASHRAE/ANSI Standard 135-2001), clause 12). The DEVICE object defines certain communication parameters; VTS uses these parameters to define how it initiates and responds to messages. Other standard BACnet objects can also be created in each Device definition, in order to simulate a full-featured BACnet device.

Port:

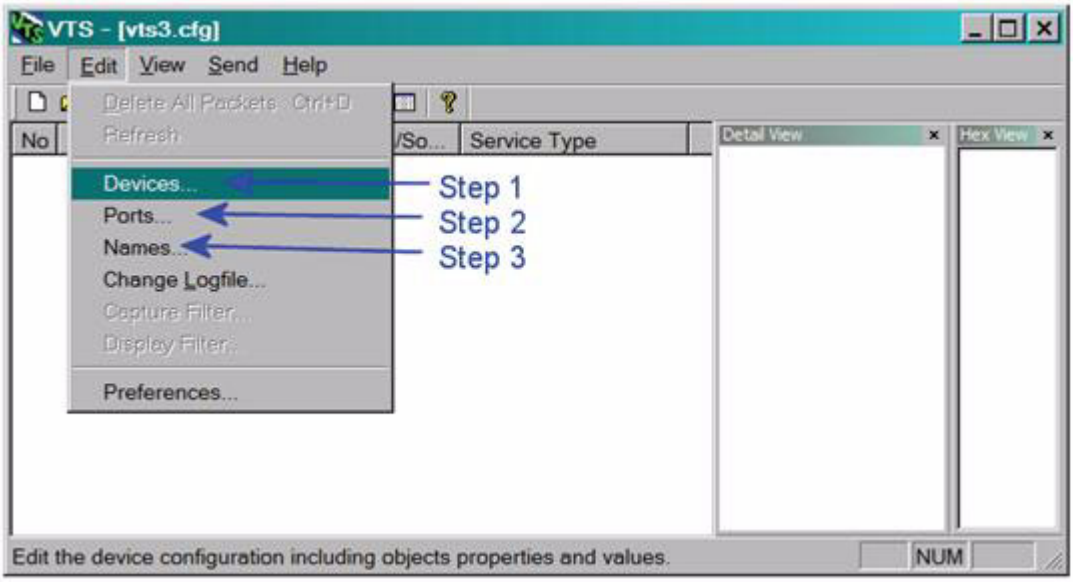
A port is a connection point to a communication medium, such as Ethernet or the Internet Protocol (IP). In order to communicate over a medium, VTS must have a Port defined for that medium.

Name:

A Name is a user pseudonym for a BACnet address. The address can be a unicast address (a specific device), or a broadcast address. A Name defined in VTS can be used in scripts and in manual tests in place of the address that it represents.

The configuration of each of these components is described below.

Each of these steps is performed by selecting the appropriate menu item from the Edit menu as shown below.

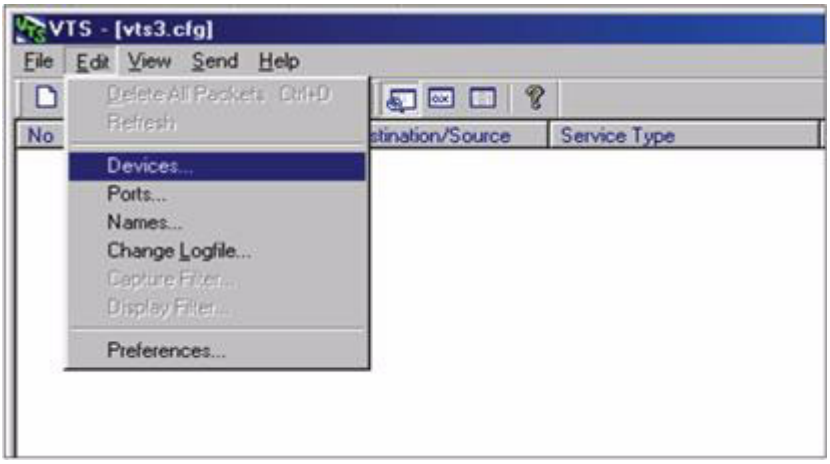


5.3.1 Device Configuration

This section is for creating Devices and Objects that are hosted within the VTS program. In other words, Devices and Objects created here will exist inside the VTS workstation for the purpose of providing test Devices and Objects that can be accessed from an external BACnet client application that is being tested. If an external client sends ReadProprty or WriteProperty requests directed at the Devices and Objects created here, VTS will automatically respond to those requests.

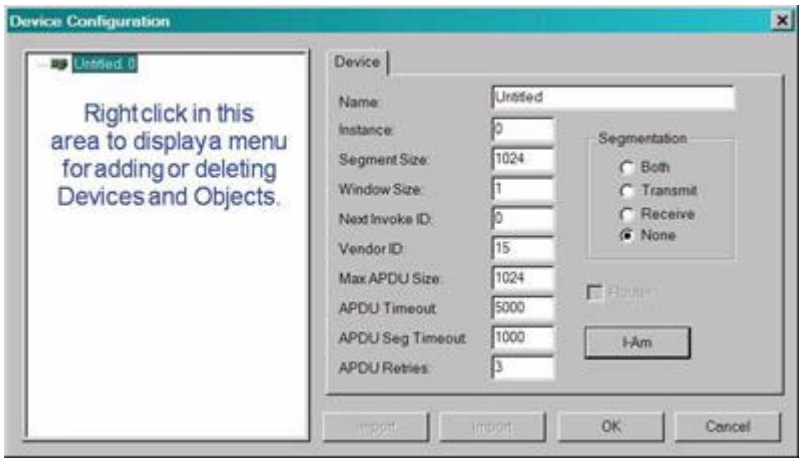
To configure a local device object for VTS:

Step 1. In the Edit menu, click [Devices].

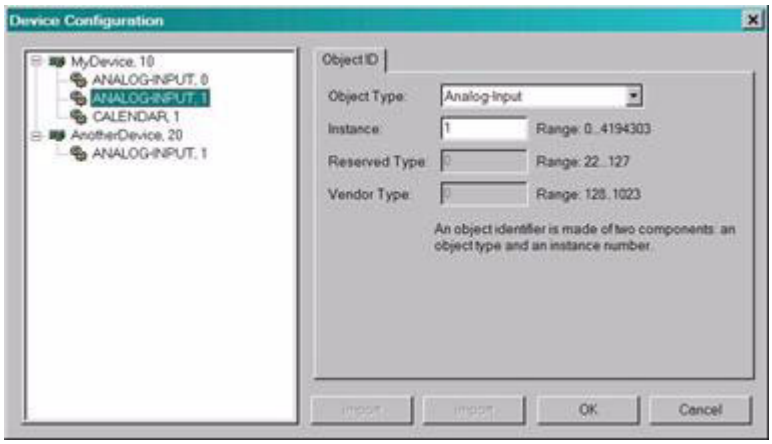


Step 2. Right-click for [New Device].

There is no need to click the OK button after each Object is added. Simply keep right clicking within the tree to add more Objects, and then click OK when finished. Clicking the Cancel button will cancel all of the changes that were made since the dialog box was first displayed.



Here is an example showing two Devices with some Objects within each Device. (The standard Properties of each standard Object type are not yet supported.)

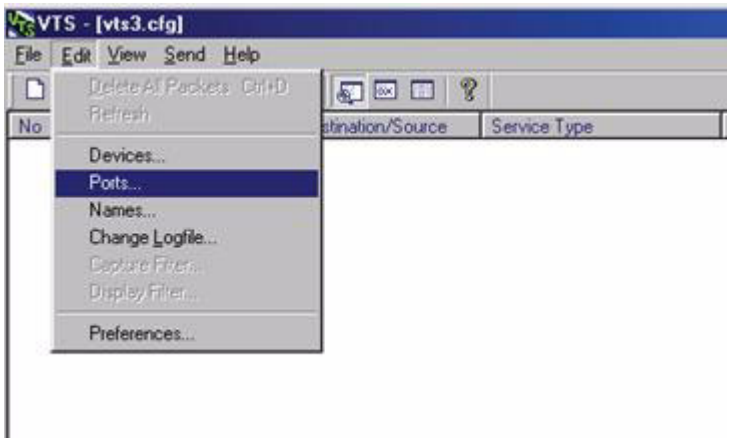


5.3.2 Port Configuration

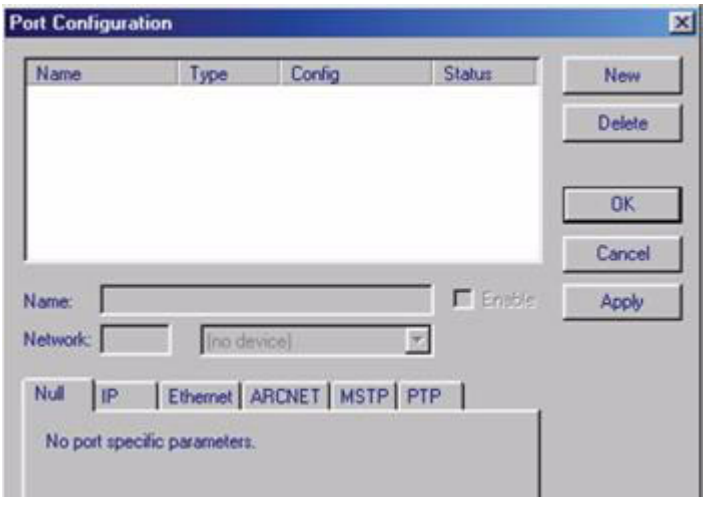
A port is a communications endpoint that sends and receives packets. Some ports are associated with a physical interface such as an Ethernet communications card, and others such as IP ports are associated with a UDP port.

Step1:

In the Edit menu, click [Ports]

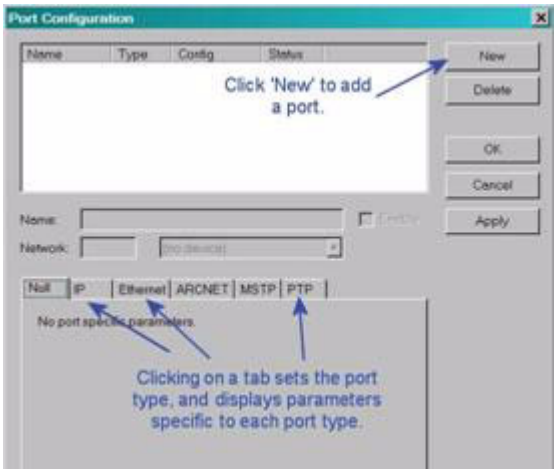


Then the Port Configuration dialog will appear.



Step2:

To create a new Port configuration, click the “New” button. A new port entry will be created with the name “Untitled”, and make up a name for the Port



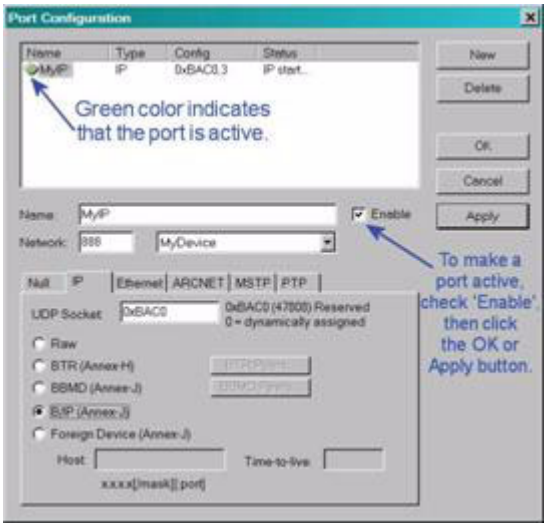
Step 3:

Enter the correct Network number into the [Network] and enter the associated local Device object (see the DEVICE) section, above.

Step 4:

For BACnet/IP ports, the socket 0xBAC0 (or 47808) is the typical socket number.

Last, in order to allow the port to communicate, must click the [Enable] checkbox.



When a port is enabled, it is available for sending and receiving packets, and the status indicator will be green. If the status indicator is red, there is some problem enabling the port and a description will appear in the status column.

Ports are not actually created or enabled until the OK or Apply button is clicked. (This is different than previous releases of VTS, which created the port while it was being configured).

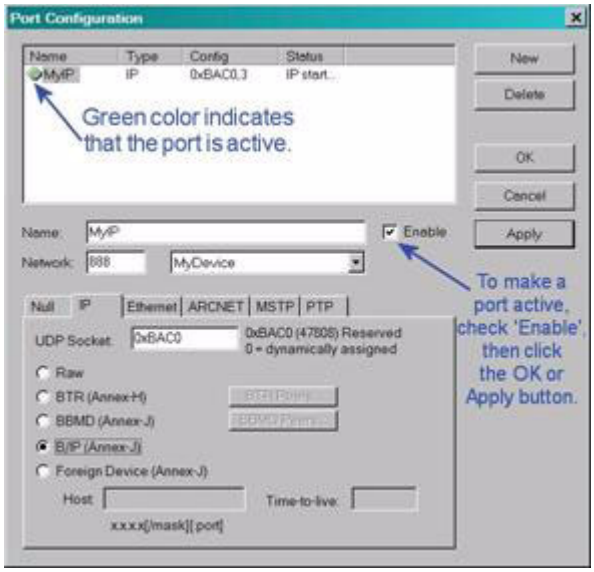
Note! *Associating more than one port to the same Device will cause VTS to function as a BACnet Router between those ports, which is usually unexpected behavior and might cause some scripts to malfunction.*

5.3.3 Name Configuration

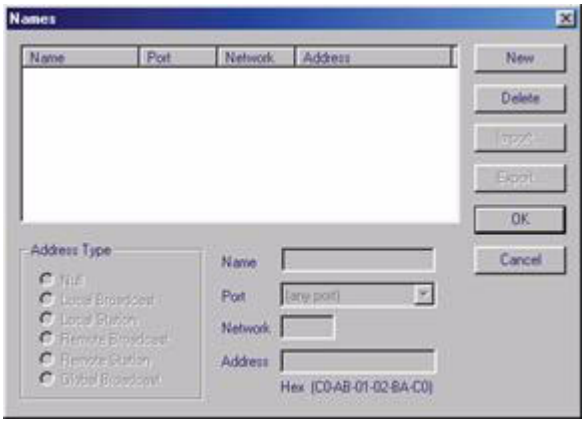
A name is a shortcut for an address. Names are used in the source and destination address areas of ports, as well as the SNET and DNET portion of the BACnet network layer. Select Names from the Edit menu and you will be presented with the following dialog box:

Step1:

In the Edit menu, click [Ports]

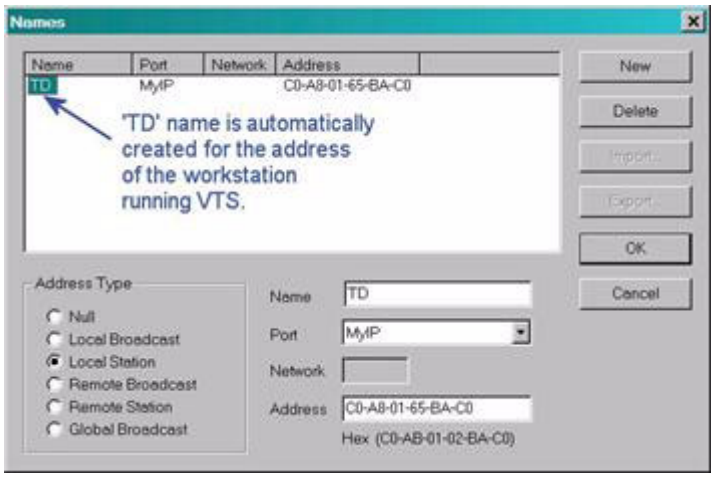


Then the Port Configuration dialog will appear.



Step 2:

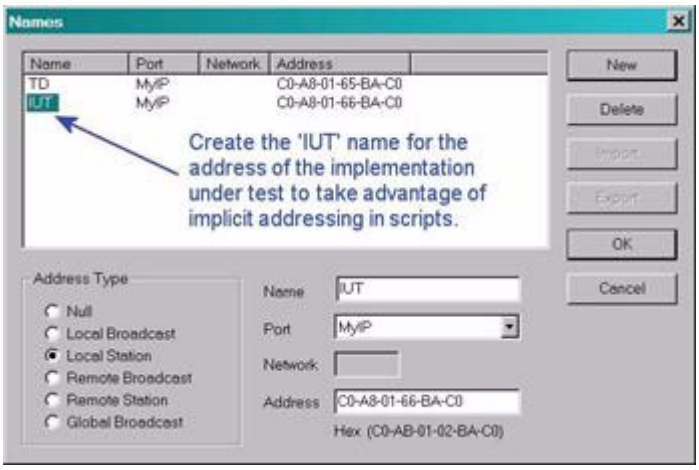
Click “New”. An untitled Name entry will be created. Notice that there is already a name TD (common abbreviation for Test Device) defined and given the address of the port. If this was an Ethernet port, TD would be the Ethernet address of the port.



Step3:

Click New, change the name to IUT, and then enter the address of the implementation under test. Remember, you must create an entry for the device being tested and it must be named “IUT”.

Note! *The IUT name has special meaning in VTS because scripts will automatically SEND and EXPECT messages from whatever address is associated with the IUT name as long as an explicit destination address is not specified in the script.*



Step 4:

Choose an Address Type for the Name. The available types are:

Null:	No type chosen. Use this when you aren’t sure what Address Type is appropriate and want to fill it in later
Local Station:	Any device on the local network.
Remote Station:	Any device on a network other than the TD’s local network.
Local Broadcast:	Packets are sent to all devices on the local network
Remote Broadcast:	Packets are sent to all devices on the specified network
Global Broadcast:	Packets are sent to all devices on all reachable networks

Note! *If the Address Type is Remote Broadcast or Remote Station, specify the remote network number in the "Network" field.*

Step 5:

Choose a Port. If no Port is configured (see "Port Configuration" above), the only choice available will be "(any port)".

5.4 Sending BACnet Packet

Tester can use VTS to test a BACnet device by Manually sending BACnet messages one packet at a time and visually examining return packets to verify test results. This chapter explains how to use VTS manually.

When To Send Packets Manually

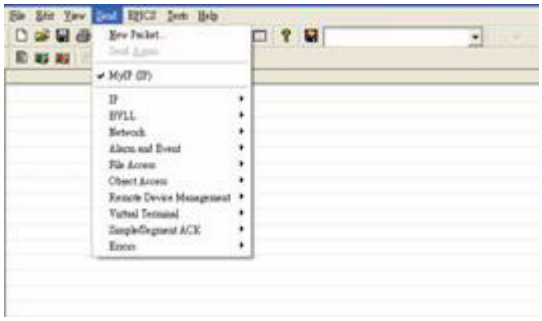
Manual operation is best used to:

- Verify a VTS configuration (i.e. ensure VTS can communicate with an IUT)
- Run quick tests that would take more time to run with a script
- Find devices on the network
- Debug test scripts

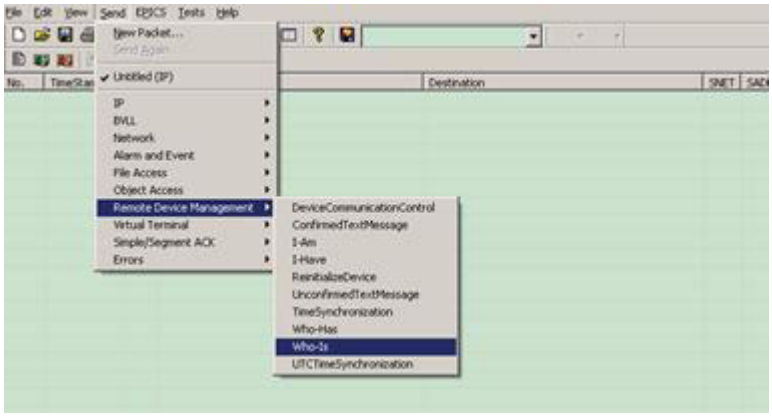
Typically, testers send specific types of packet, such as Read-Property. To create packets, the Send menu has an entry for each Network or Application packet.

Step1:

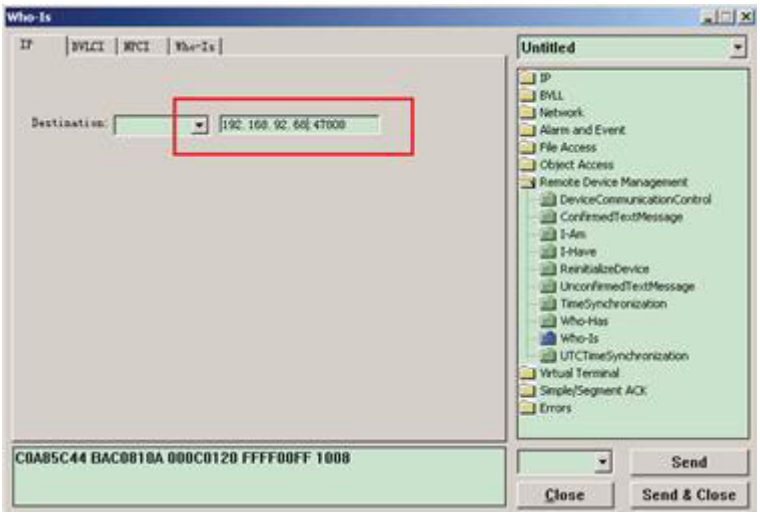
To send packets with VTS, use the [Send] menu



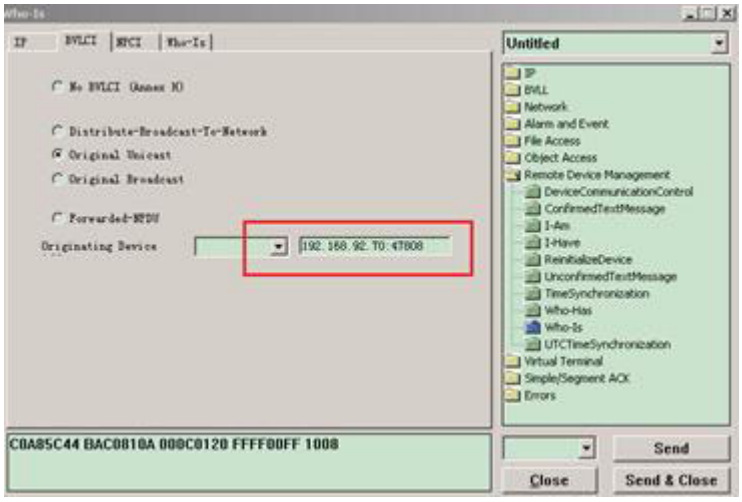
We can find our BAS-30XXBC IO module series by instruction [Who-Is], Select [Send] -> [Remote Device Management] -> [Whos-Is].



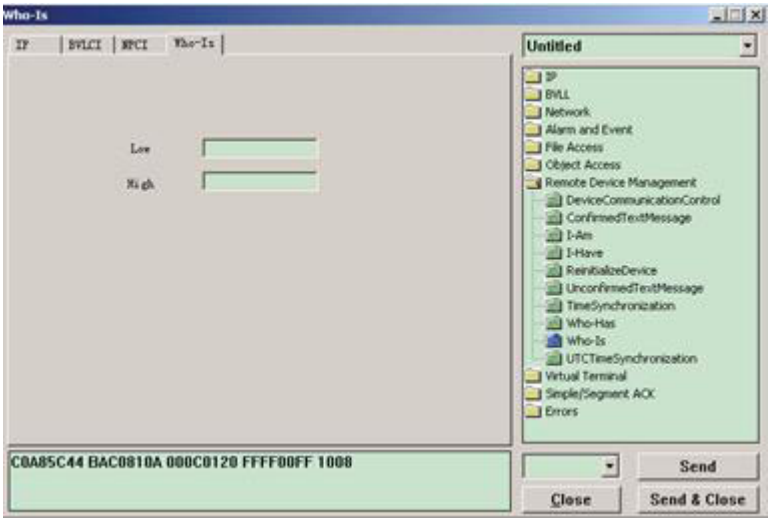
Input user’s router IP and UDP port number.



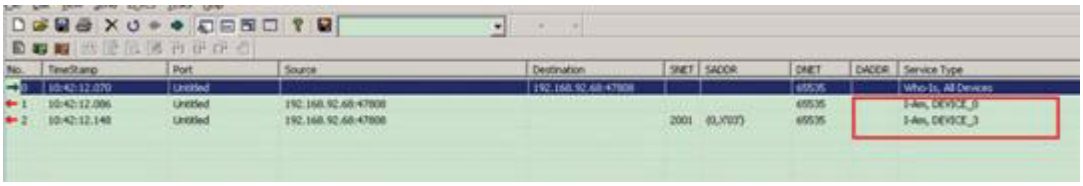
Select [BVLCI], and select device IP



In [Who-IS] item,



And you press [send], IO modules in BACnet network will reply I-Am.



The Send Dialog:

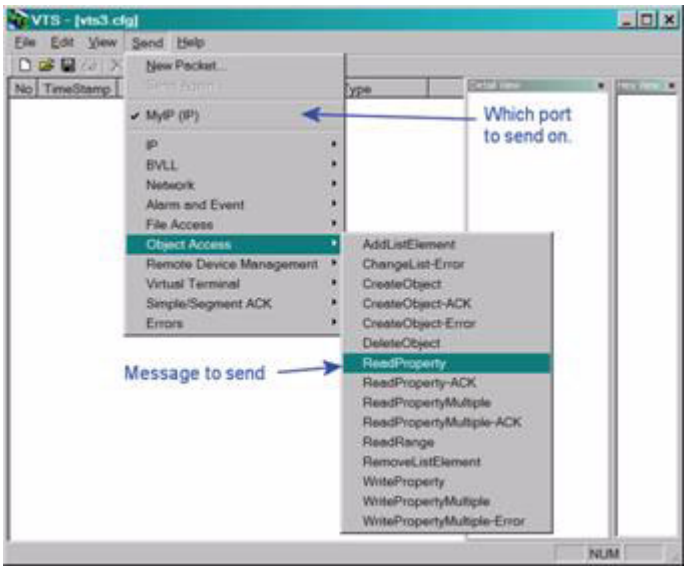
All of the commands in the Send menu open the Send dialog. The Send dialog allows a user to create (and send) any valid (or even invalid) BACnet packet.

When a packet type is chosen from the Send menu, the Send dialog will appear, with tabs for each layer of the packet (e.g. physical, data link, network). On each tab are appropriate fields to be filled in for each layer.

Some fields in each packet, and in each layer, are required. If the packet is incomplete, the “Send” button will be disabled and the Status box at the bottom left of the Send dialog will indicate what information is missing from the currently selected tab.

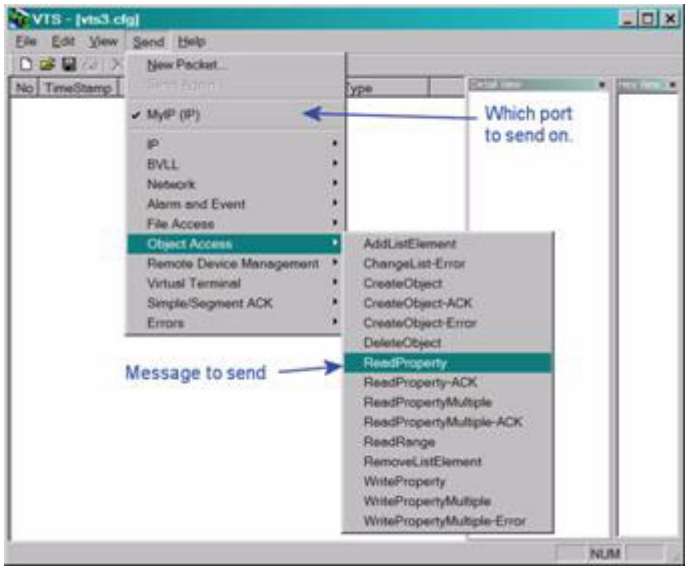
5.4.1 Read Property

The most basic function of VTS is to send and receive packets and decode them. Click on the Send menu and you will see a menu that looks like this:

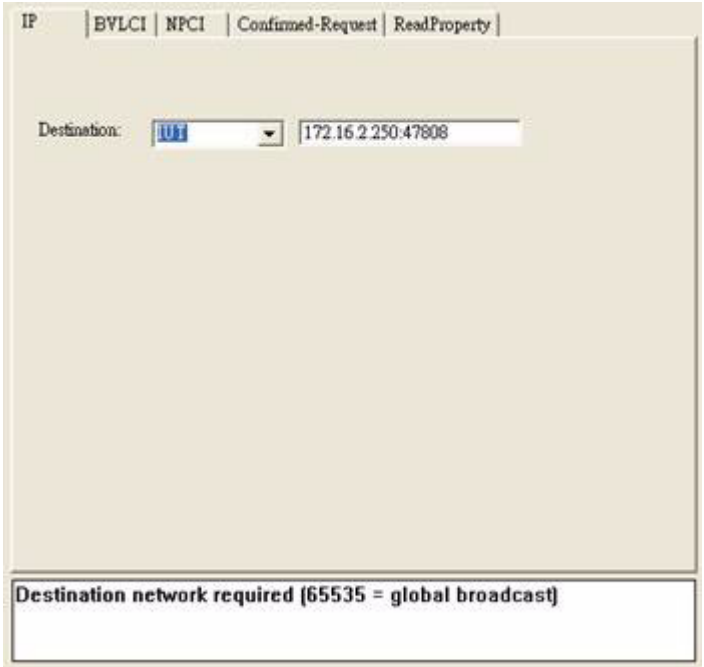


The MyIP name that is selected is the port created in port configuration. There is only one enabled port, so it is selected by default, and below the port is a hierarchical menu of families of types of packets. The BVLL menu has BACnet/IP specific packets such as Register-Foreign-Device. The Network menu contains BACnet networking packets such as Who-Is-Router-To-Network. The other menus are common groups of application layer messages.

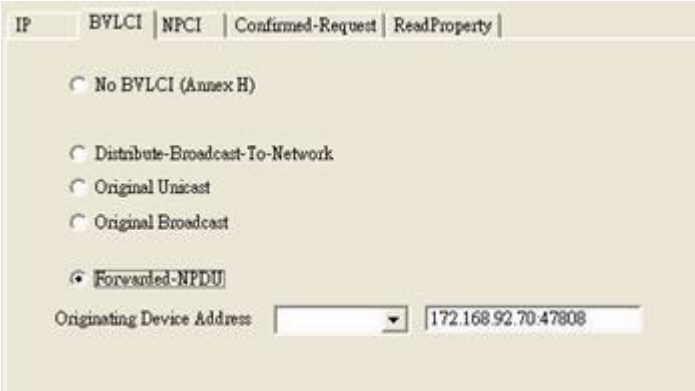
Select [Send] -> [Object Access] -> [ReadProperty]



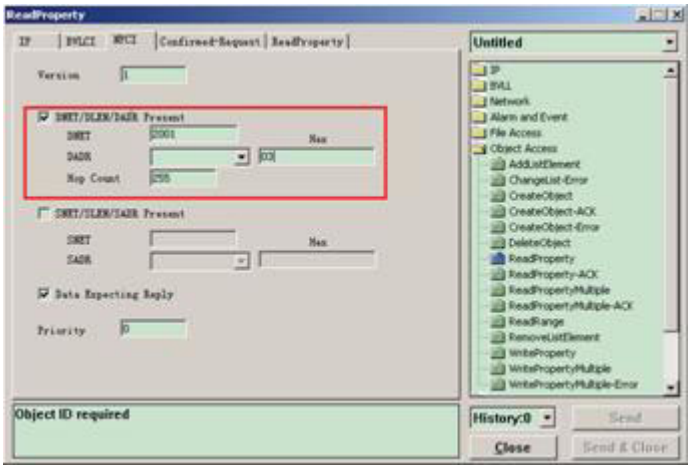
Please input target address IP:



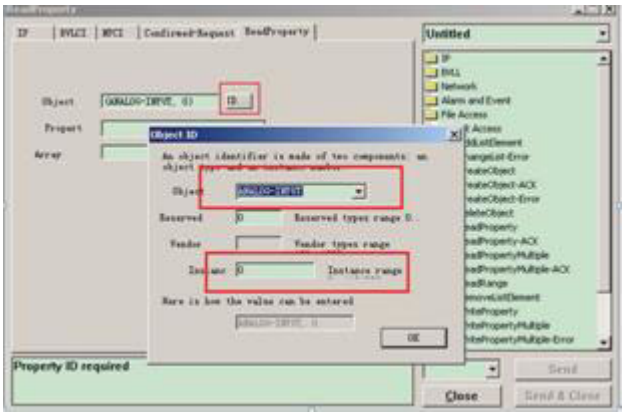
Input local device IP



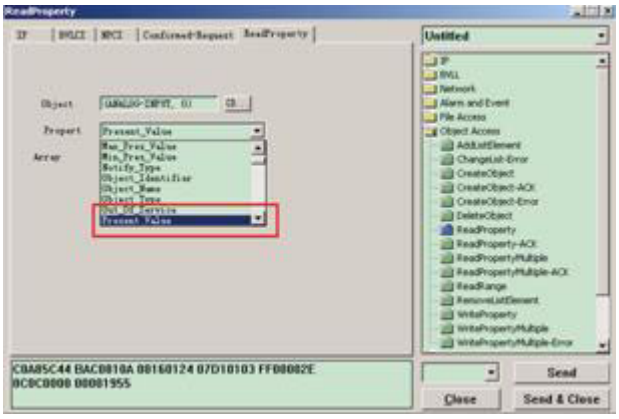
In [DNET] select 2001 and [Hex] fill MAC address of BACnet 30XXBC IO module



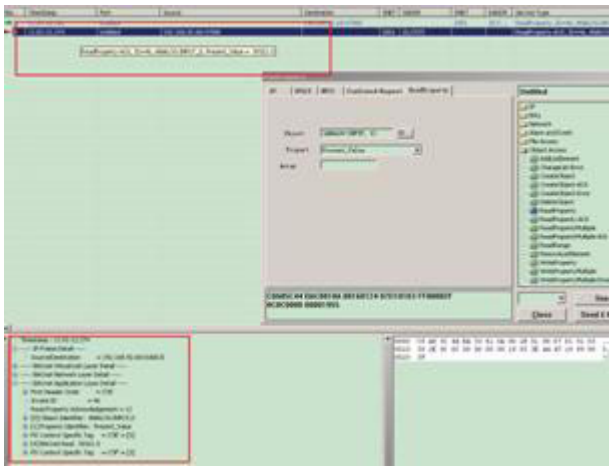
In [ReadProperty] item, press [ID] then select object InstanceEX: AI / 0



In property, Select Read Property present value

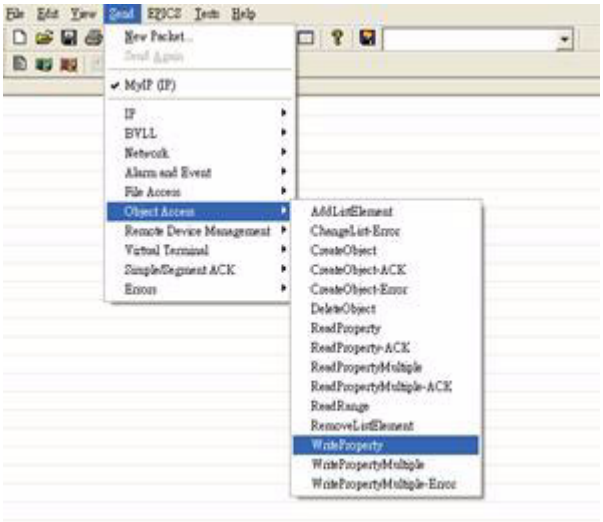


After set up basic configuration, press [send] to check result then you can see it.



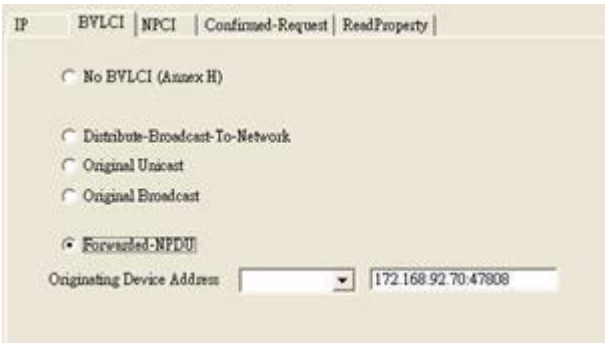
5.4.2 Write Property

Select [Send] -> [Object Access] -> [ReadProperty].

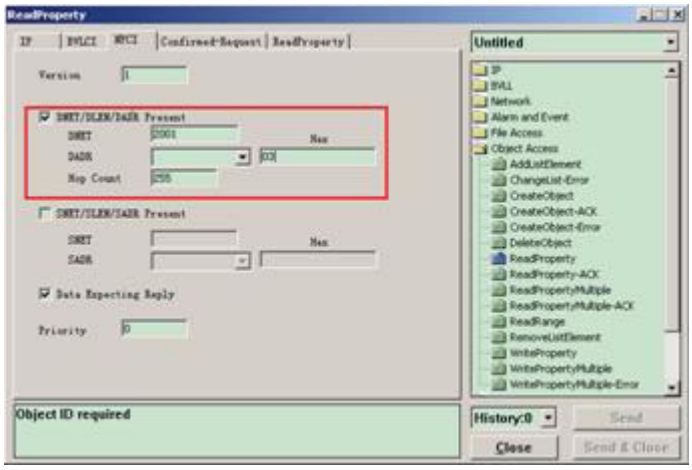


Please input target address IP:

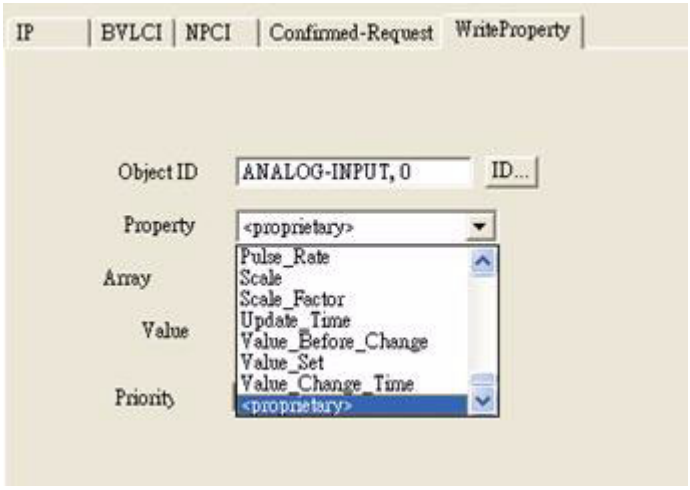
Input local device IP

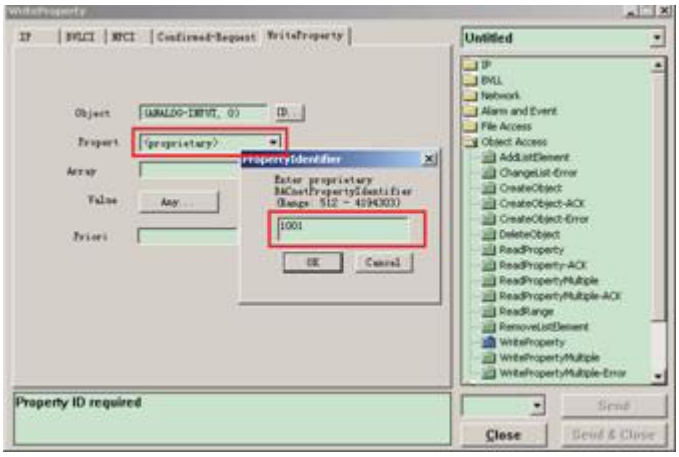


In [DNET] select 2001 and [Hex] fill MAC address of BACnet 30XX IO module.

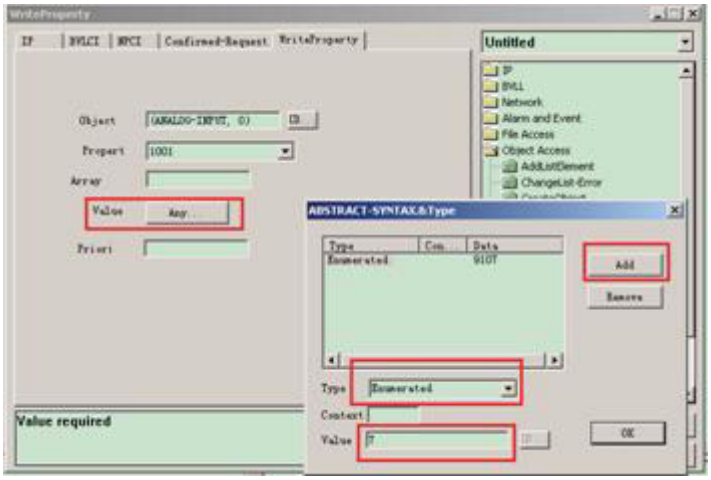


In [WriteProperty], select property and input 1001 for range code.

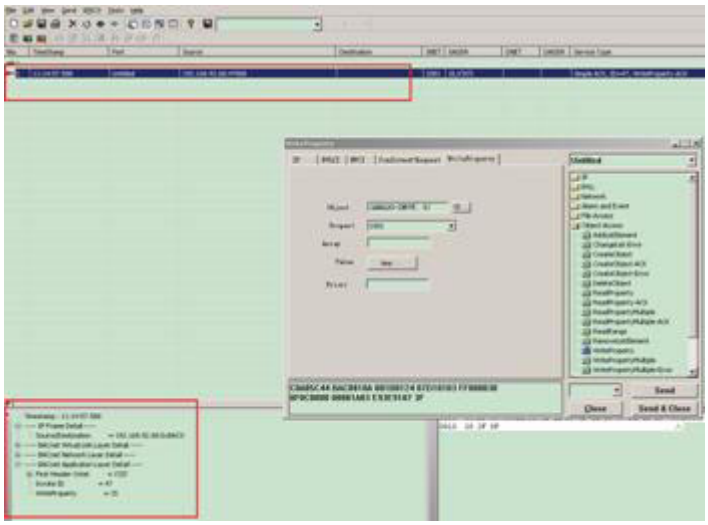




Select [Value] and press [Any], add new enumerated data type and value, then press [Send].



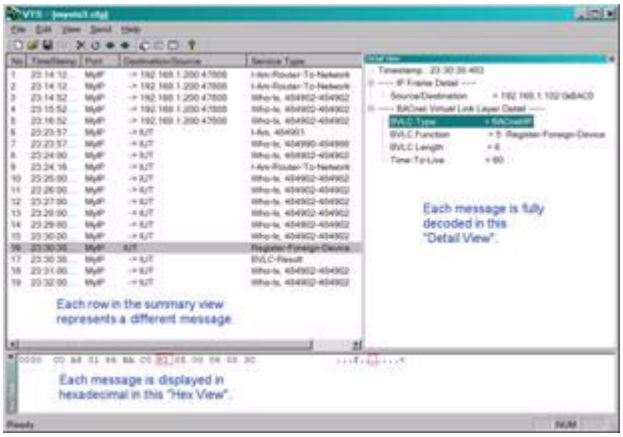
After it receive reply message and no error that means it writable.



5.5 Analyze BACnet Packet

VTS is able to act as a network “sniffer” (a program that detects and decodes network traffic). The sniffer capability of VTS is limited in that it only decodes and displays BACnet packets. This allows testers to see a device’s response to a particular packet, in order to determine the results of the test being conducted.

The session window contains three panes. The summary view on the left has one line per packet and provides general information such as the packet number, time it arrived, source and destination addresses, and a brief description of the packet. The detail view in the upper right contains a complete decoding of the packet contents. The hex view in the lower window displays the binary content of the packet using hexadecimal notation.


Each message is fully decoded in this "Detail View".
Each row in the summary view represents a different message
Each message is displayed in hexadecimal in this "Hex View".

The three views are synchronized so selecting a detail row will highlight the hex encoding of that specific portion of the packet with a red box.

The Detail and Hex views can be rearranged within the VTS window by dragging their title bars to the desired new location. The dividers between the views can also be moved to resize the adjacent views at the same time.

Appendix A

I/O Wiring

A.1 BAS-3051BC

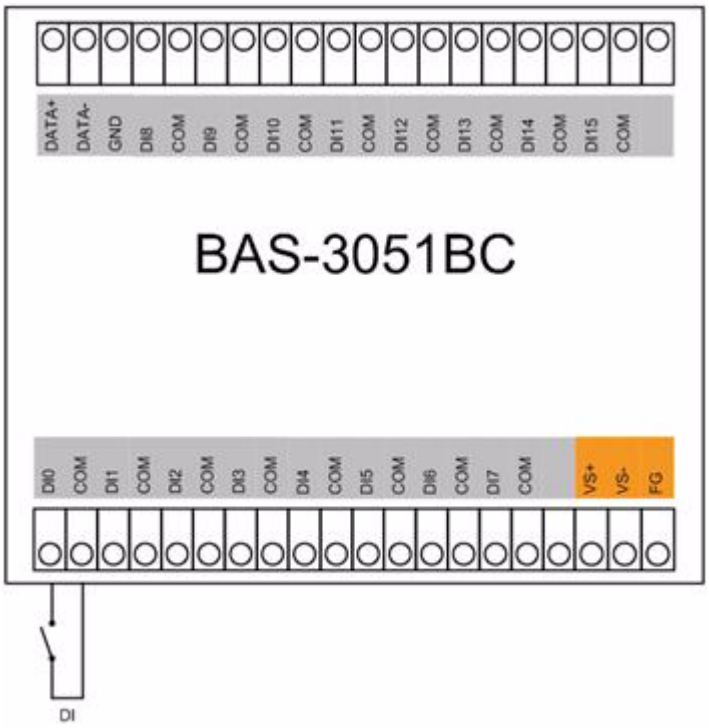


Figure A.1 BAS-3051BC Connection

A.2 BAS-3050BC

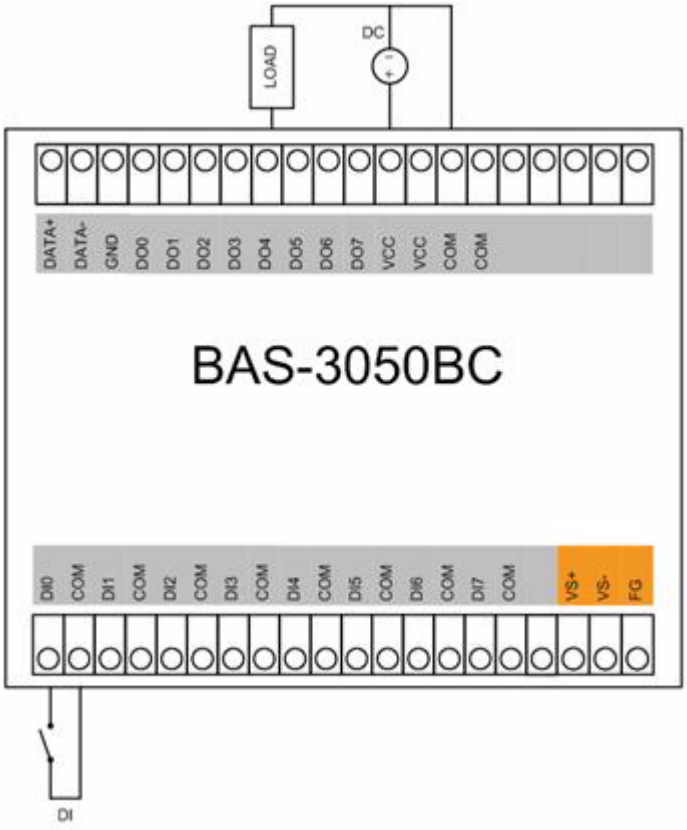


Figure A.2 BAS-3050BC Connection

A.3 BAS-3018BC

Advantech provides a 125 register for the UI connector to enable 0-20mA.

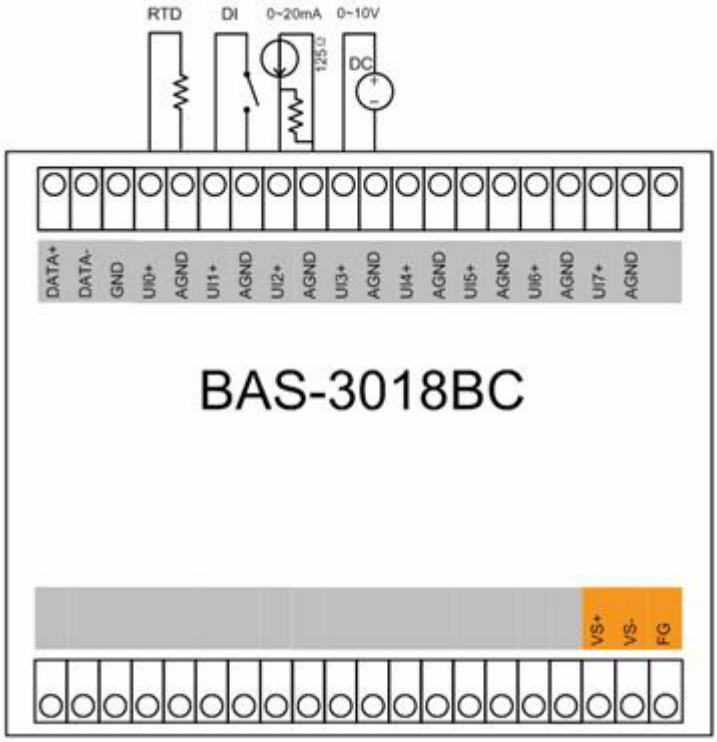


Figure A.3 BAS-3018BC Connection

A.4 BAS-3024BC

Advantech provides a 125 register for the UI connector to enable 0-20mA.

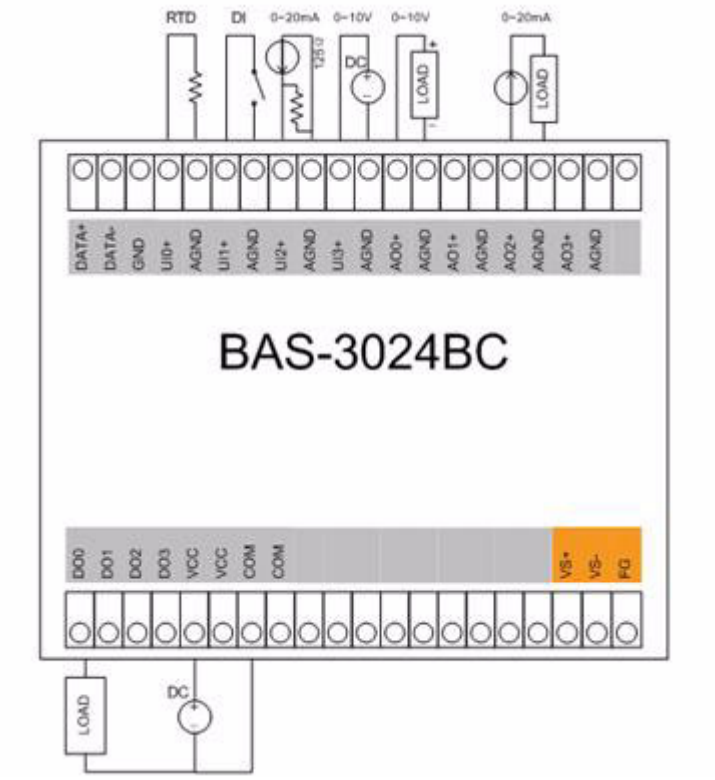


Figure A.4 BAS-3024BC Connection

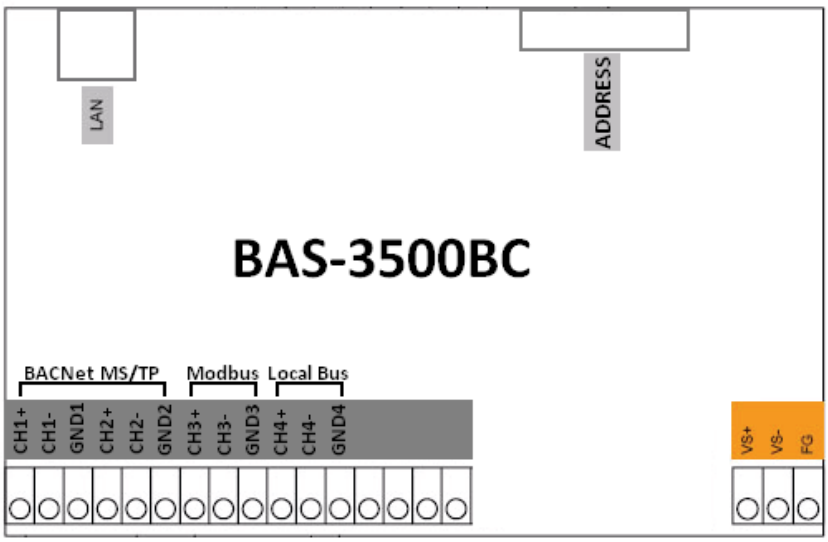


Figure A.5 BAS-3500BC Connection

Appendix B

RS-485 Network

B.1 Introduction

EIA RS-485 is the industry's most widely used bidirectional, balanced transmission line standard. It is specifically developed for industrial multi-drop systems that should be able to transmit and receive data at high rates or over long distances.

The specifications of the EIA RS-485 protocol are as follows:

- Maximum line length per segment: 1200 meters (4000 feet)
- Throughput of 10 M baud and beyond -Differential transmission (balanced lines) with high resistance against noise
- Maximum 32 nodes per segment
- Bi-directional master-slave communication over a single set of twisted-pair cables
- Parallel connected nodes, true multi-drop

BAS-3000BC remote I/O modules are fully isolated and use just a single set of twisted pair wires to send and receive! Since the nodes are connected in parallel they can be freely disconnected from the host without affecting the functioning of the remaining nodes. An industry standard, shielded twisted pair is preferable due to the high noise ratio of the environment.

In this case, the master is a personal computer that is connected with its serial, RS-232, port to an ADAM RS-232/RS-485 converter (like ADAM-4520). The slaves are the BAS-3000BC remote I/O modules. When modules are not transmitting data, they are in listen mode. The host computer initiates a command/response sequence with one of the systems. Commands normally contain the address of the module the host wants to communicate with. The system with the matching address carries out the command and sends its response to the host.

B.2 Daisychain

The last module of a segment is a repeater. It is directly connected to the main-wires thereby ending the first segment and starting the next segment.

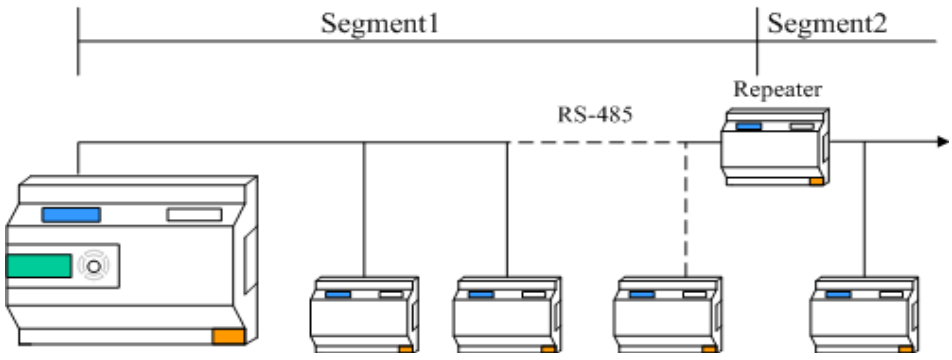


Figure B.1 Daisychaining

B.2.1 Star Topology

In this scheme the repeaters are connected to drop-down cables from the main wires of the first segment. A tree structure is the result. This scheme is not recommended when using long lines since it will cause a serious amount of signal distortion due to a signal reflection in a several line endings.

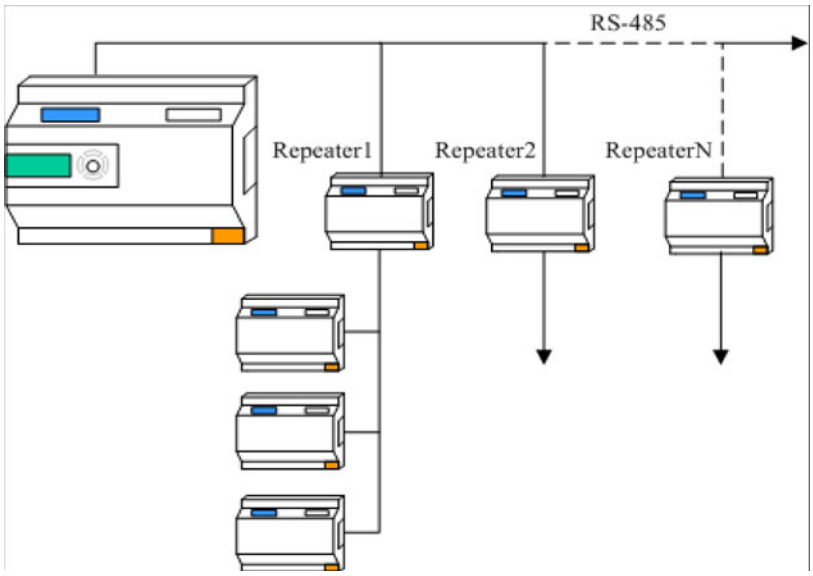


Figure B.2 Star Topology

B.2.2 Random Topology

This is a combination of daisychain and hierarchical structure

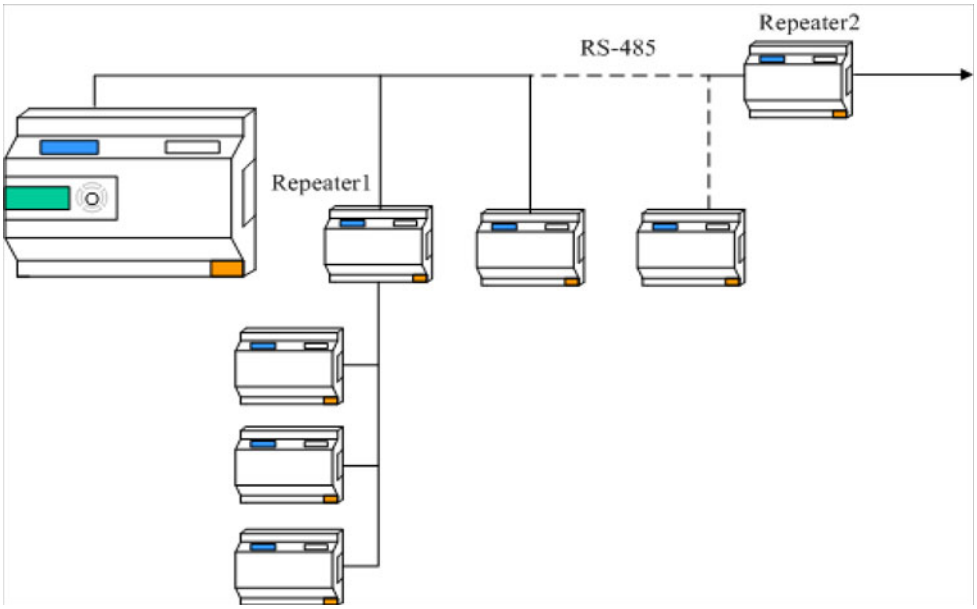


Figure B.3 Line Termination

Each discontinuity in impedance causes reflections and distortion. When an impedance discontinuity occurs in the transmission line the immediate effect is signal reflection. This will lead to signal distortion.

Specially at line ends this mismatch causes problems. To eliminate this discontinuity terminate the line with a resistor.

Figure B.4 Signal Distortion

B.3 Line Termination

Each discontinuity in impedance causes reflections and distortion. When a impedance discontinuity occurs in the transmission line the immediate effect is signal reflection. This will lead to signal distortion. Specially at line ends this mismatch causes problems. To eliminate this discontinuity, terminate the line with a resistor.

The value of the resistor should be a close as possible to the characteristic impedence of the line. Although receiver devices add some resistance to the whole of the transmission line, normally it is sufficient to the resistor impedance should equal the characteristic impedance of the line.

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